

North Atlantic Right Whale Vessel Speed Rule Assessment

June 2020

Appendix A: Figures and Tables

Note to Readers:

All vessel traffic referenced herein refers to vessels subject to the speed rule unless otherwise noted for the small vessel traffic assessment (Figures 55-58).

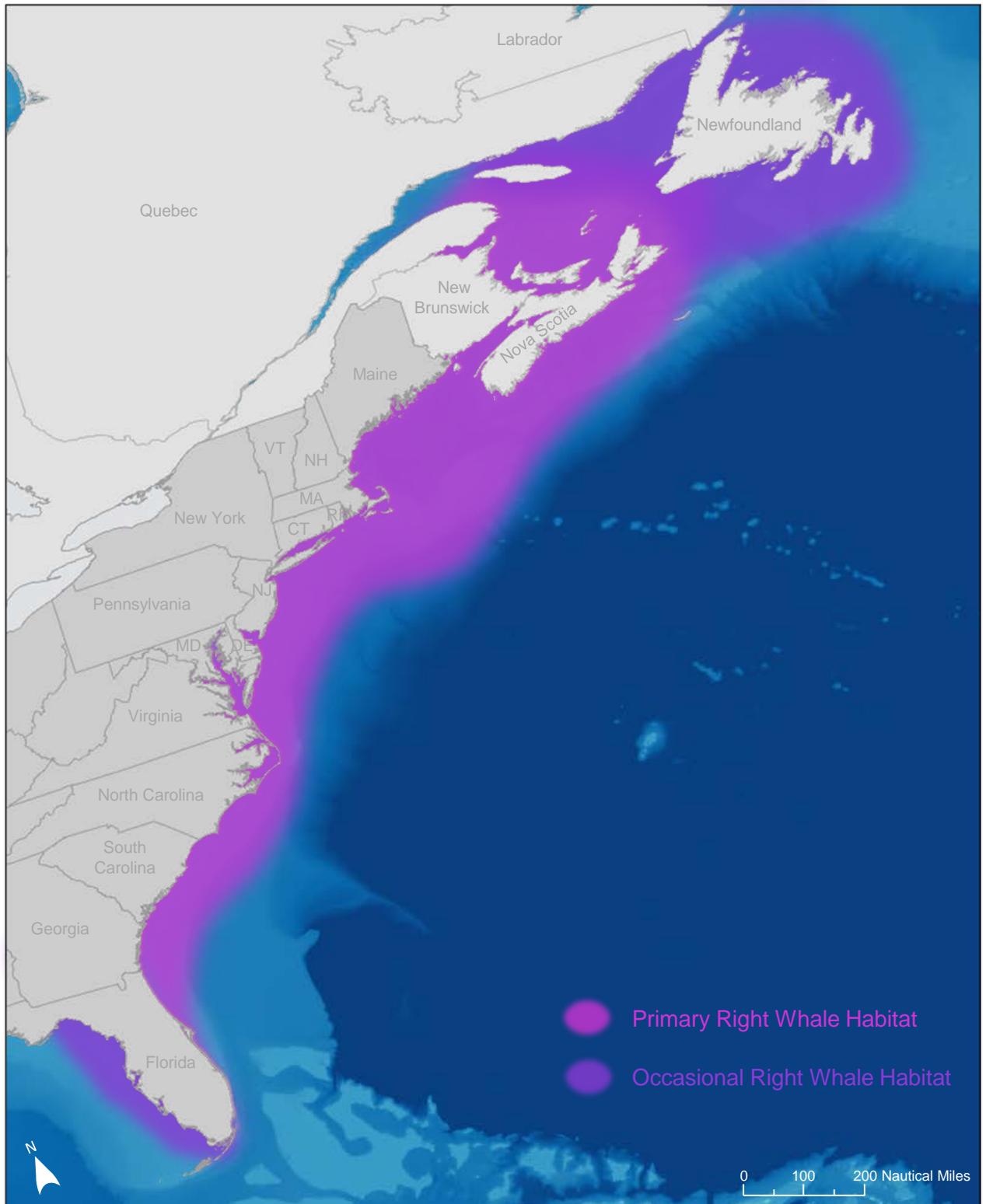


Figure 1. Right whale habitat areas in the northwest Atlantic ocean.

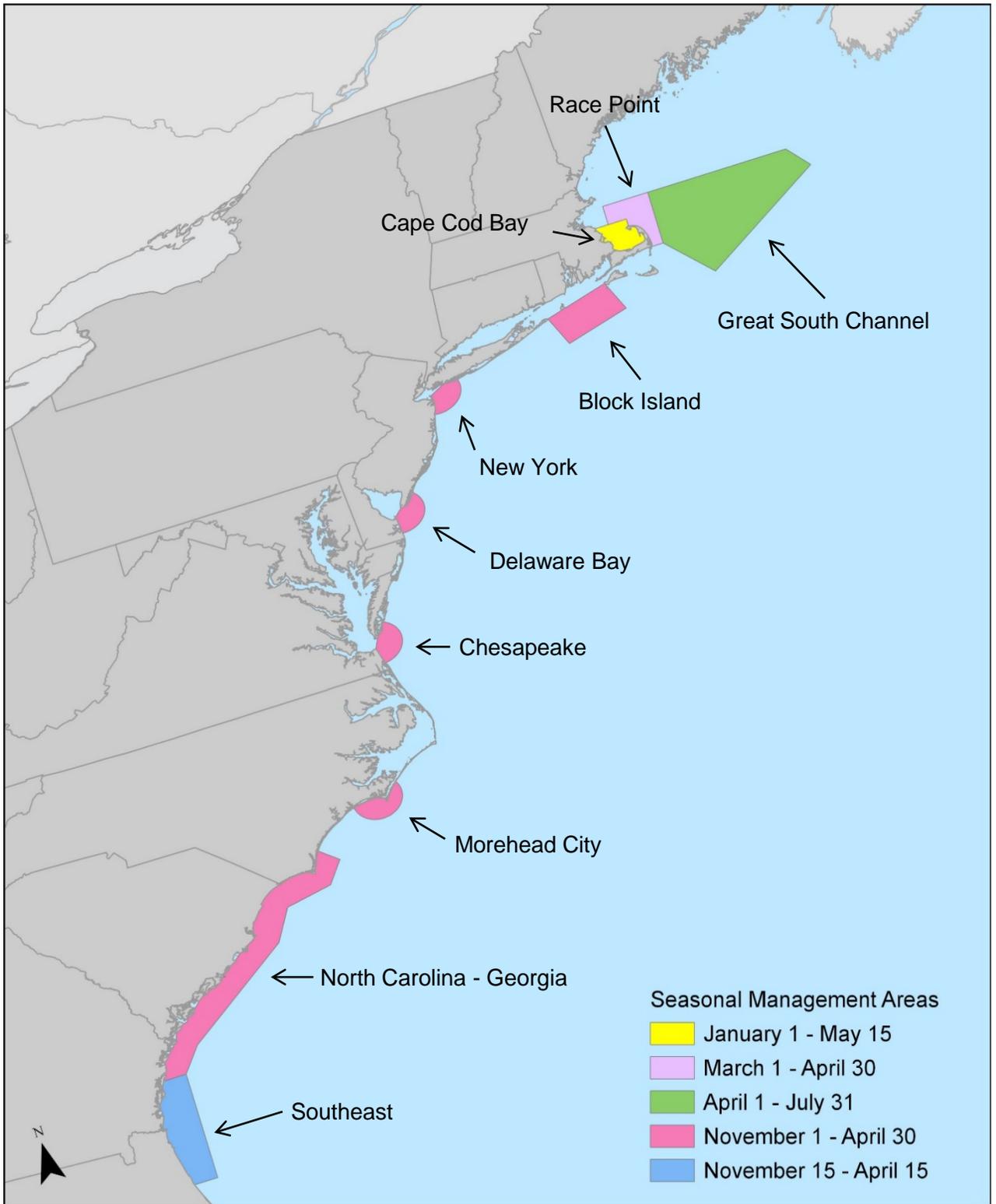


Figure 2. Seasonal Management Areas (SMAs). Most vessels greater than 65 ft in length must travel at speeds of 10 knots or less during active periods in SMAs.

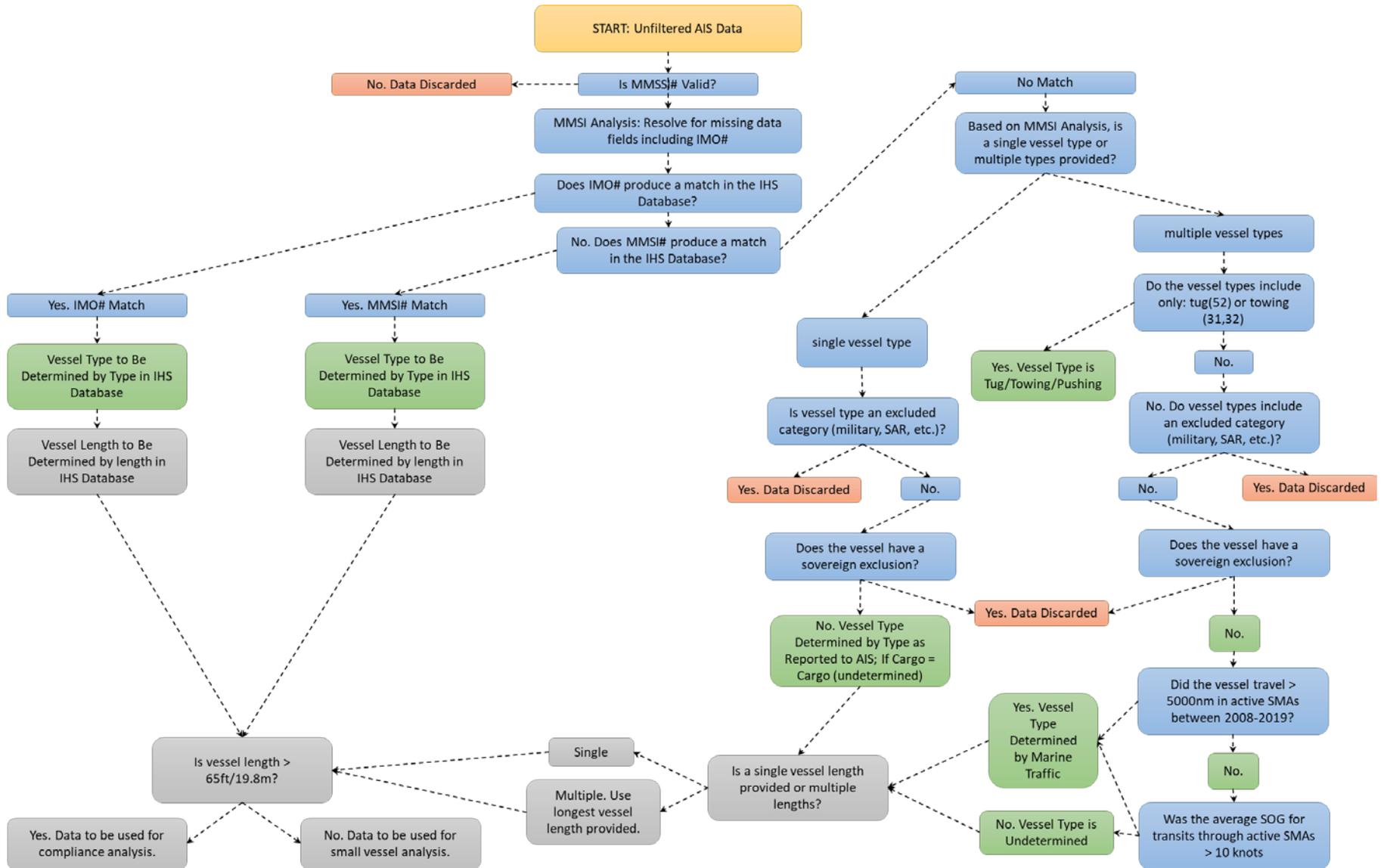


Figure 3. Decision matrix used to process unfiltered AIS data to derive vessel type and vessel length.

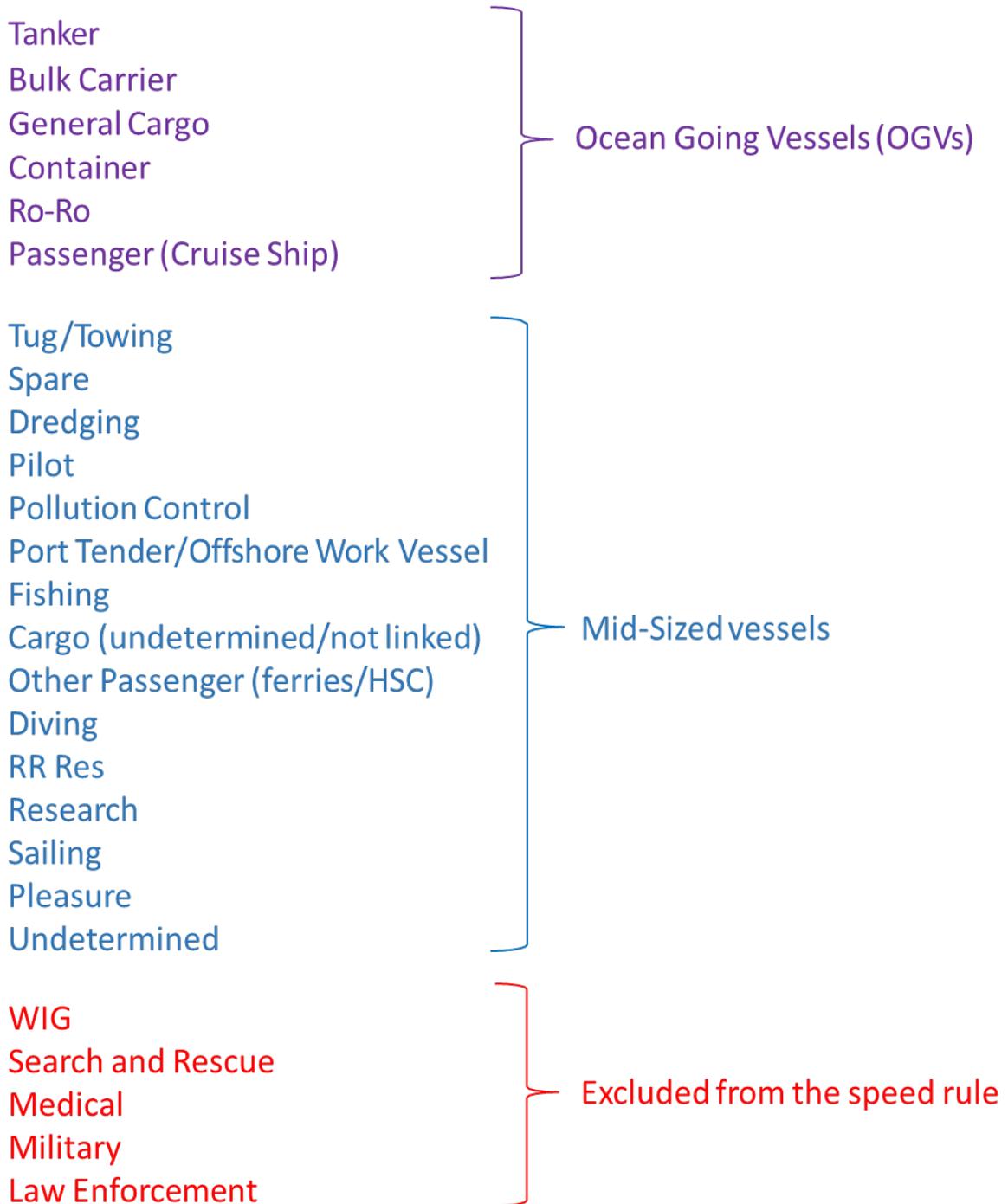


Figure 4. Vessel categories used for evaluating vessel traffic characteristics in SMAs and DMAs. Note: Vessel type “fishing” refers to commercial fishing vessels. For more information on vessel types see the USCG AIS Encoding Guide and the IHS Markit Statcode 5 Shiptype Coding System.

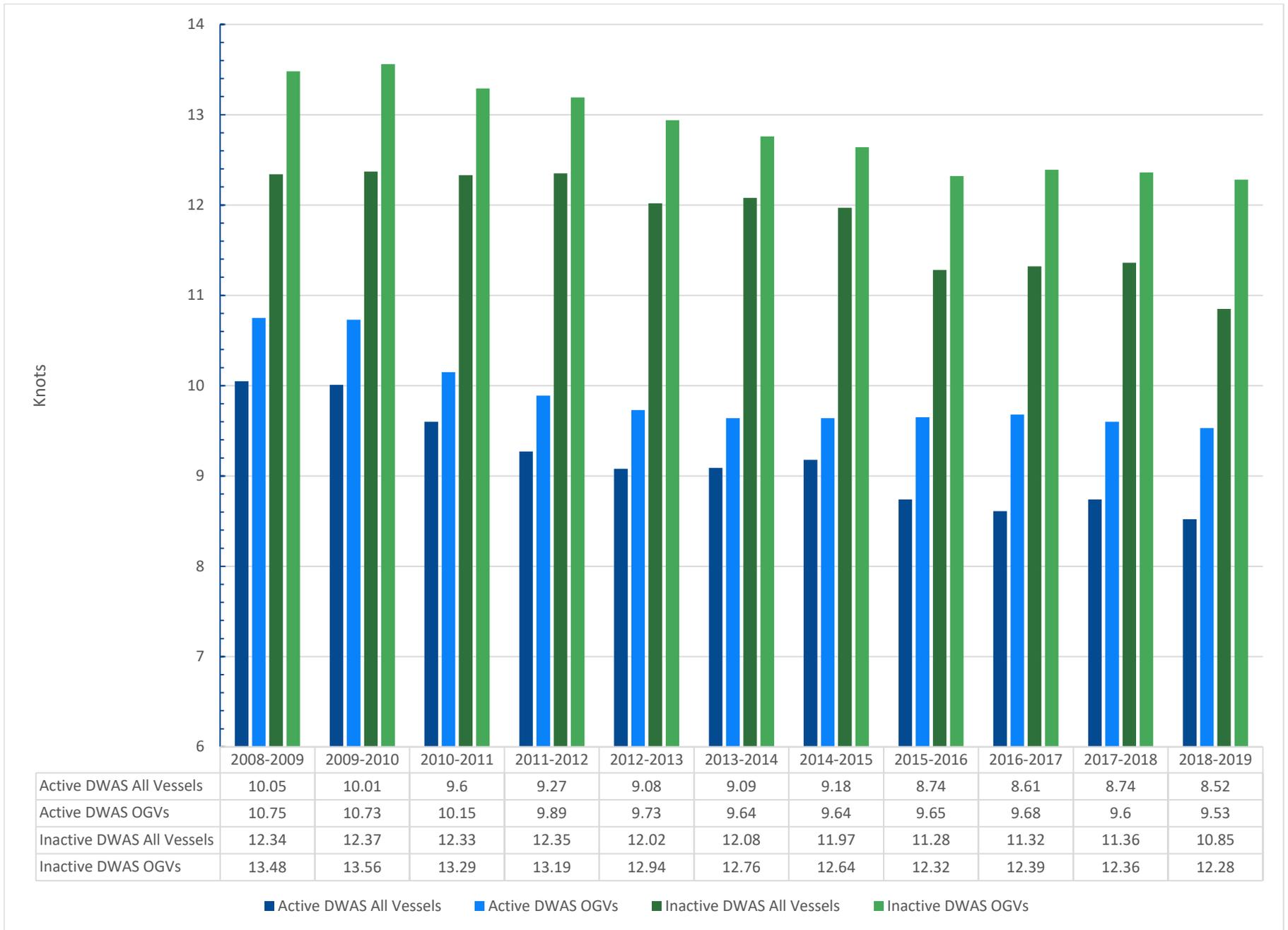


Figure 5. Distance weighted average speed (DWAS) of vessels transiting SMAs during active (blue) and inactive periods (green).

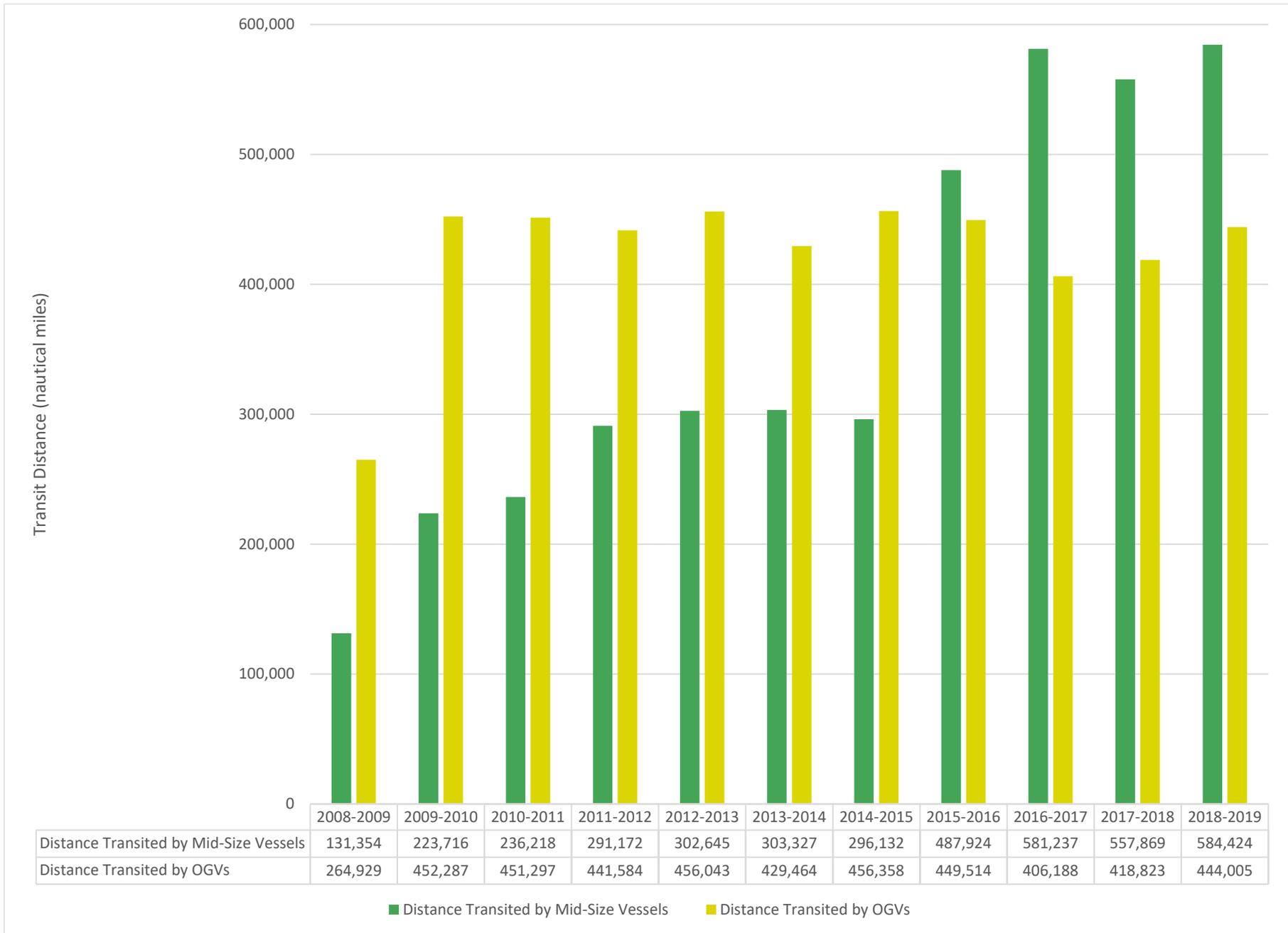


Figure 6. Total distance transited (nautical miles) through active SMAs during each season by vessel category. Note: The increase in mid-size vessel transit distance beginning in 2015-2016 is partly an artifact of changes to USCG AIS carriage requirements which resulted in many fishing vessels using AIS for the first time.

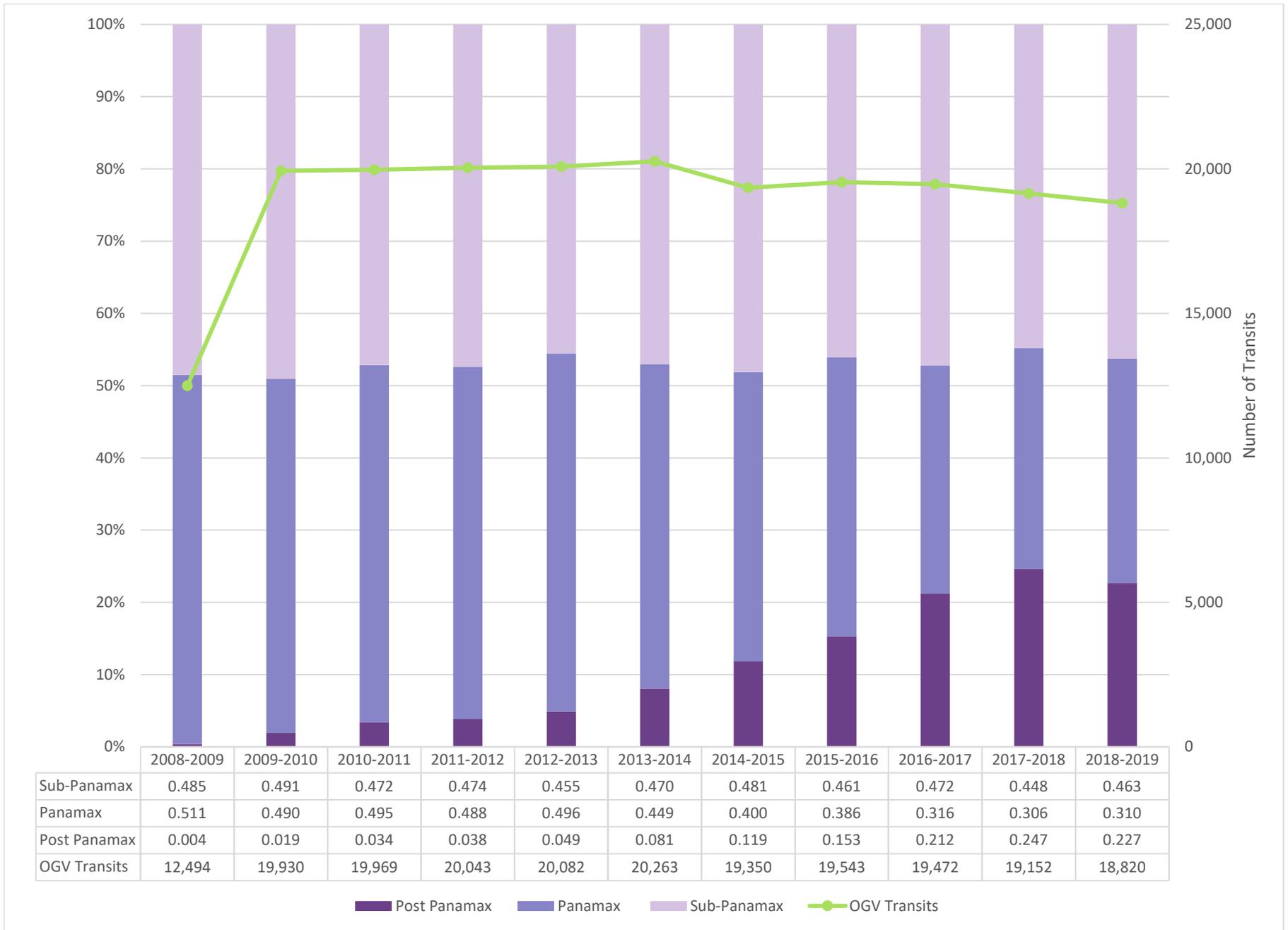


Figure 7. Proportion of OGV transits through active SMAs by size class each season. The green line indicates the total number of OGV transits each season.

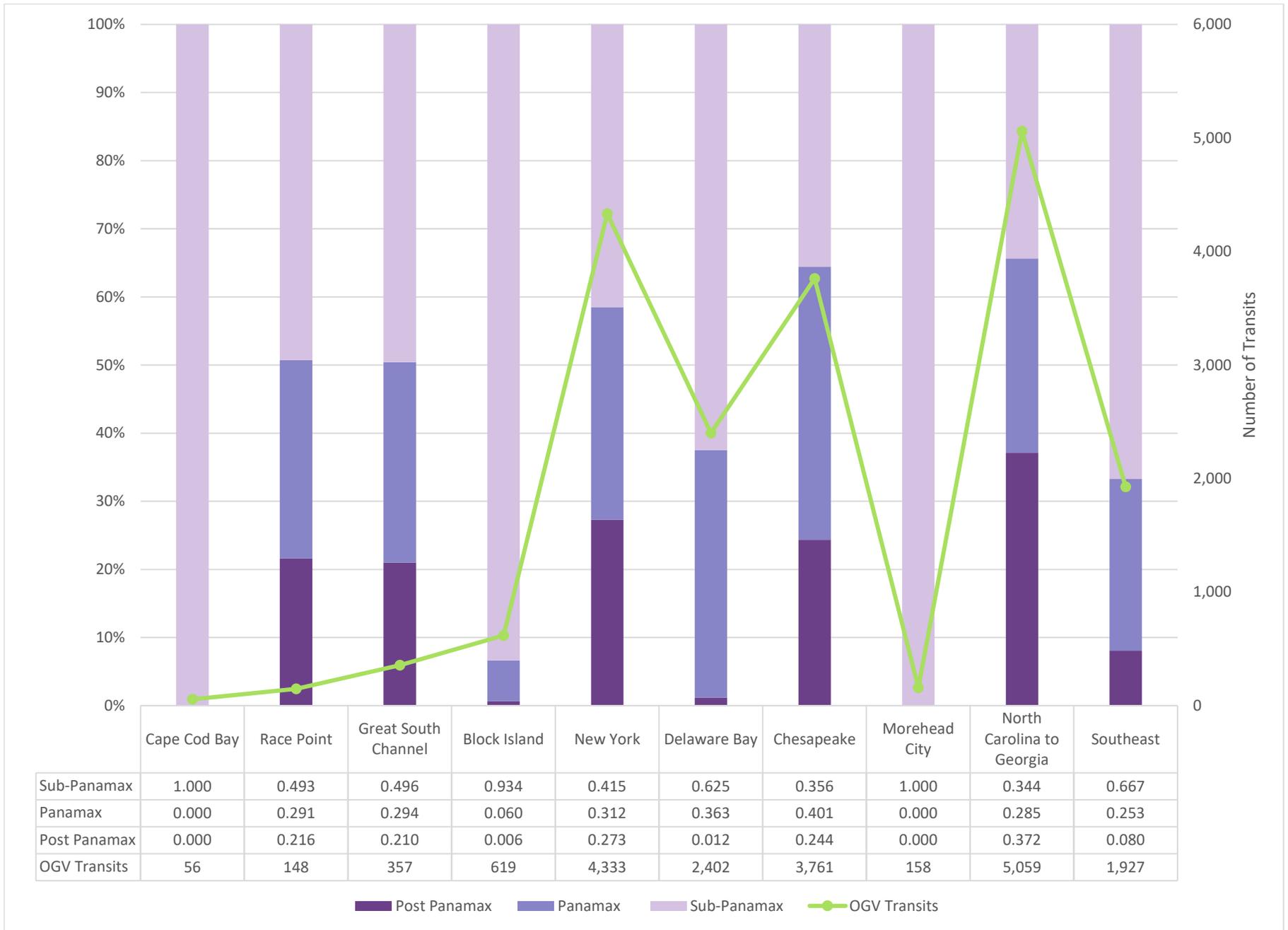


Figure 8. Proportion of OGV transits through each active SMAs during the 2018-2019 season. The green line indicates the total number of OGV transits during the 2018-2019 season.

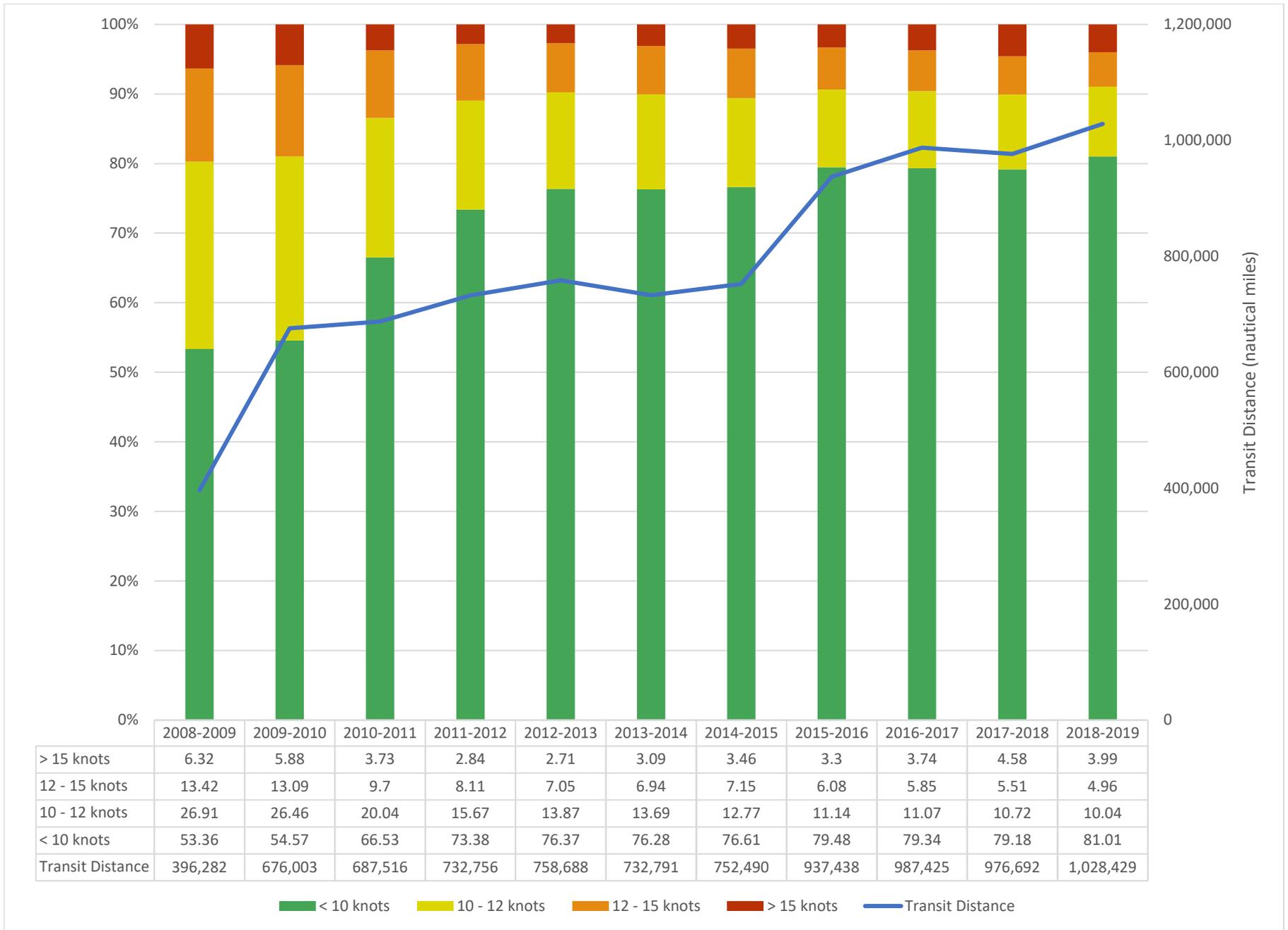


Figure 9. Proportion of total distance traveled through active SMAs by speed class each season. The blue line indicates the total distance transited each season.



Figure 10. Proportion of total distance traveled through each active SMA by speed class across all seasons. The blue line indicates the total distance transited in each SMA.



Figure 11. Proportion of total distance traveled through each active SMAs by speed class during the 2018-2019 season. The blue line indicates the total distance transited in each SMA during the 2018-2019 active season.

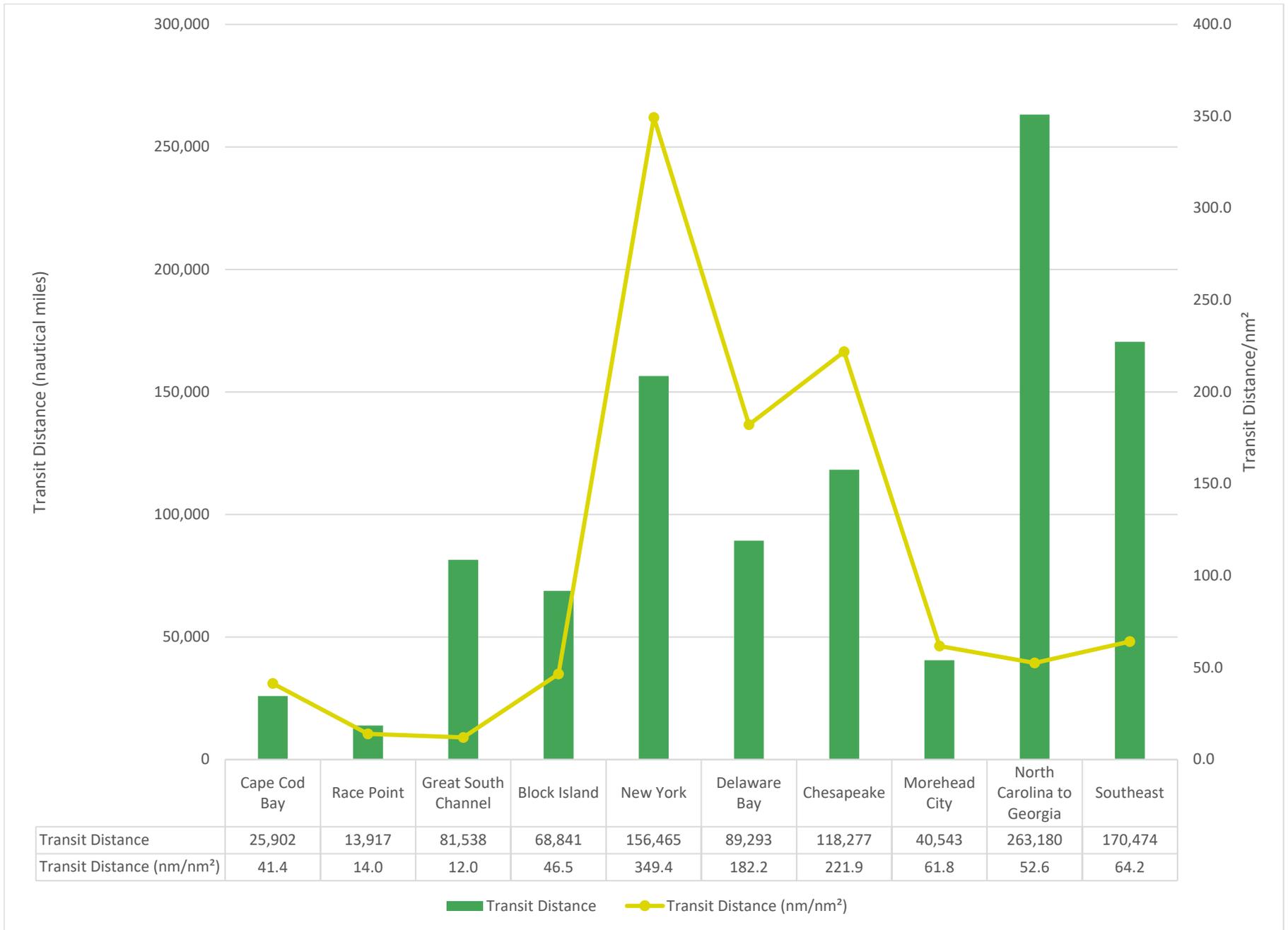


Figure 12. Total distance transited (nautical miles) through each active SMA during the 2018-2019 season (green bars) and total distance traveled relative to SMA size (yellow line).

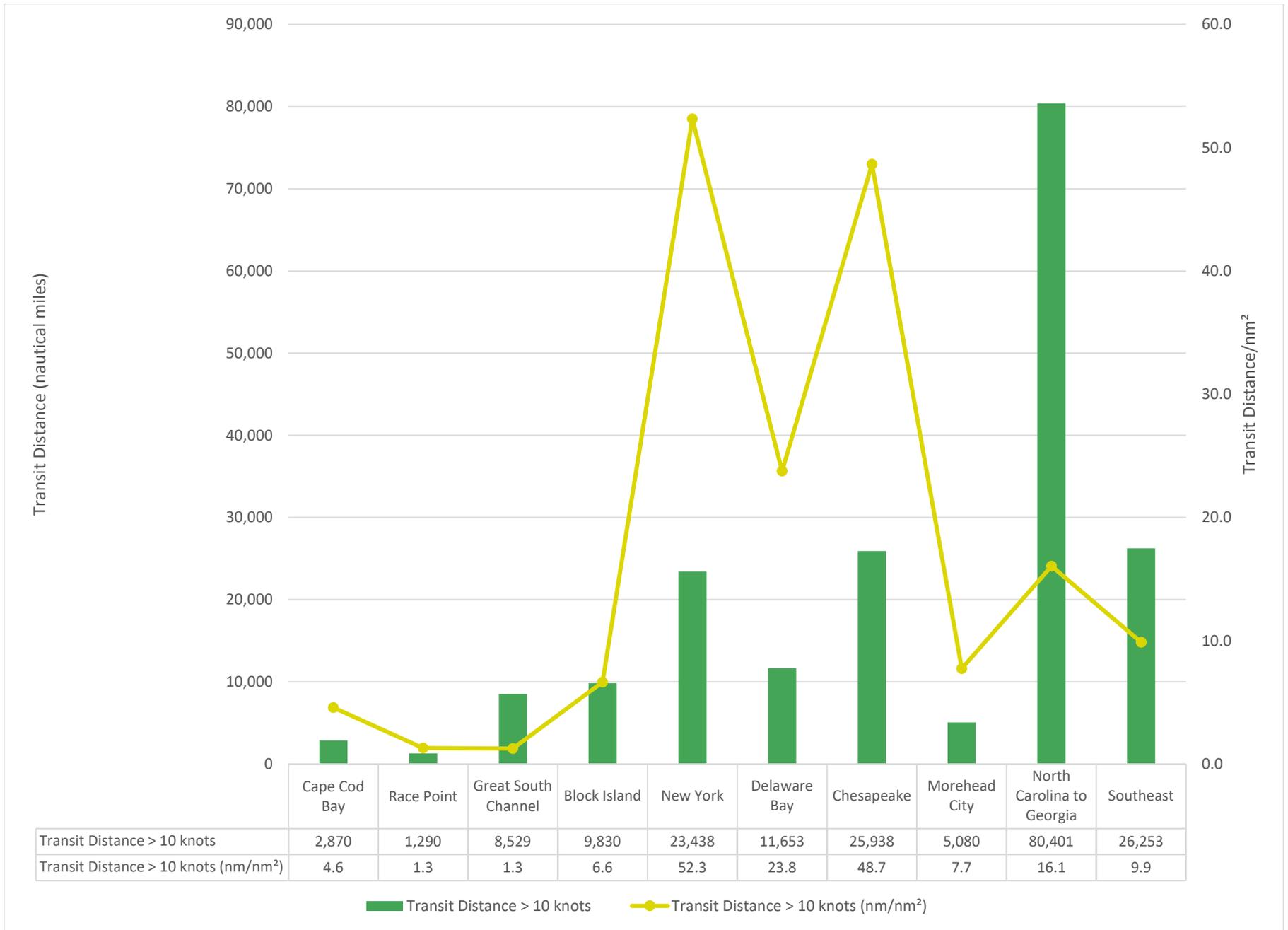


Figure 13. Total distance transited (nautical miles) at speeds > 10 knots through each active SMA during the 2018-2019 season (green bars) and total distance traveled at speeds > 10 knots relative to SMA size (yellow line).

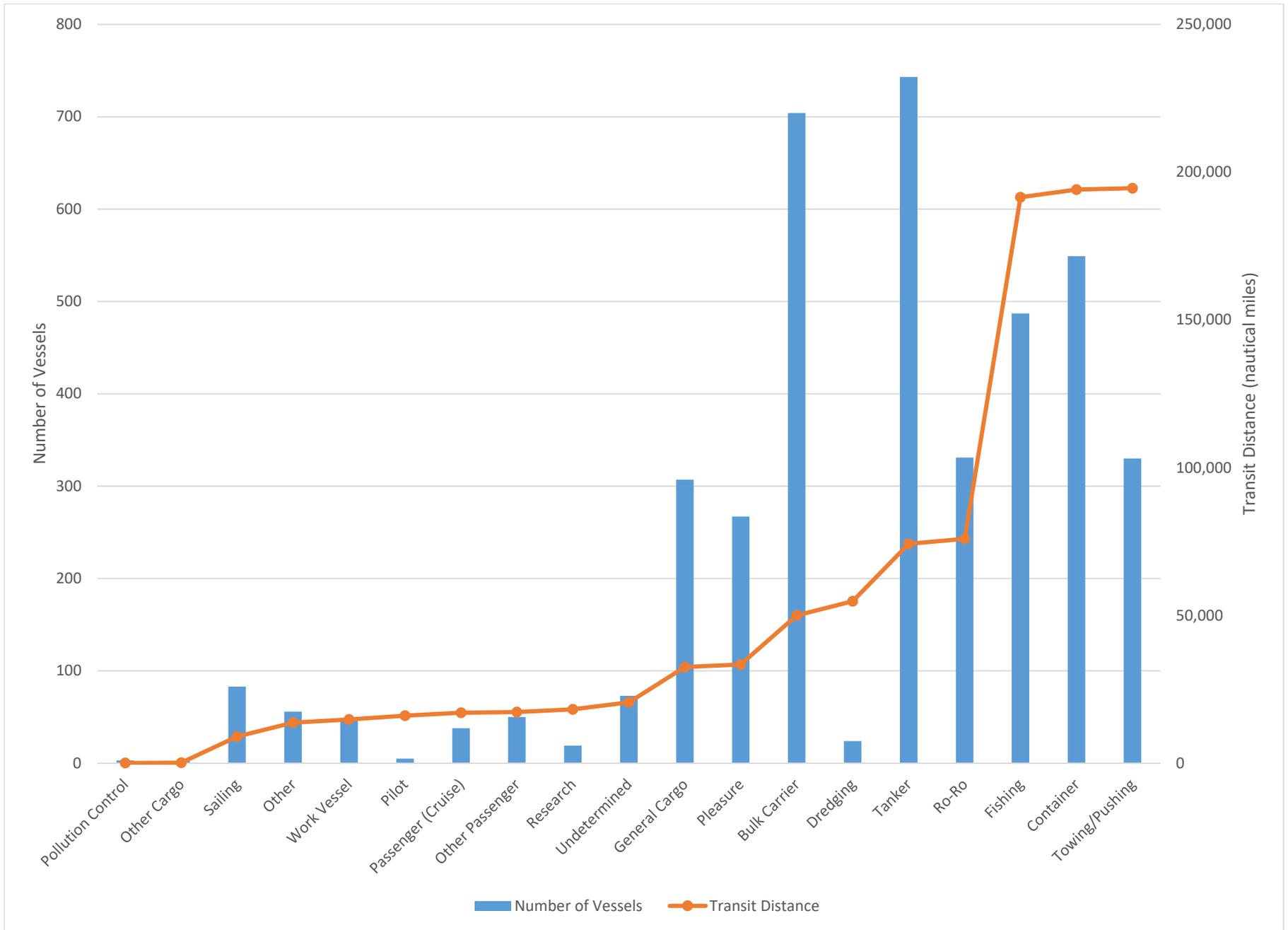


Figure 14. Number of vessels by type transiting active SMAs during the 2018-2019 season. The orange line indicates the total distance transited across all active SMAs during the 2018-2019 season.

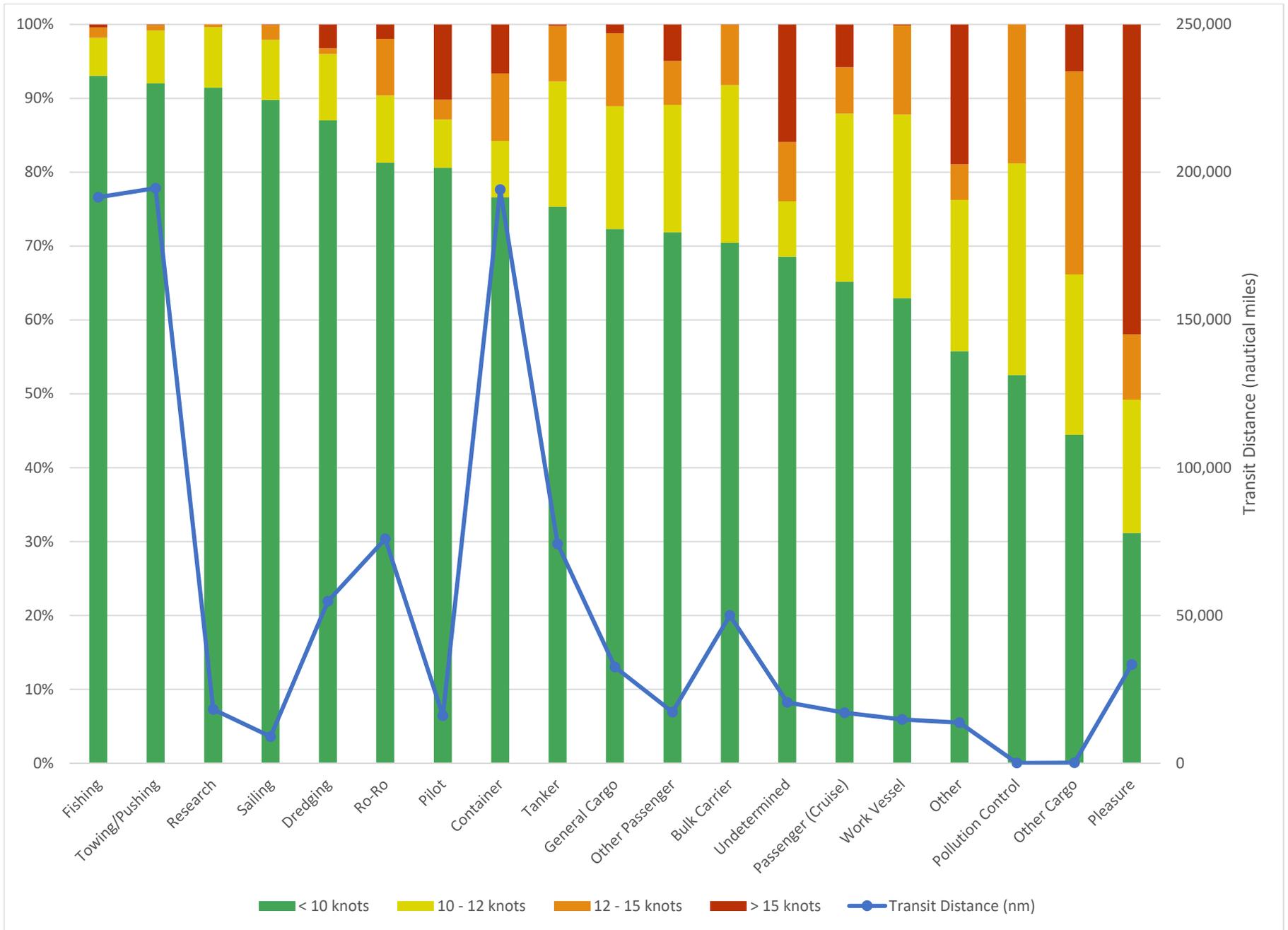


Figure 15. Proportion of total distance transited through all active SMAs by vessel type during the 2018-2019 season. The blue line indicates the total distance transited by each vessel type in active SMAs (2018-2019).

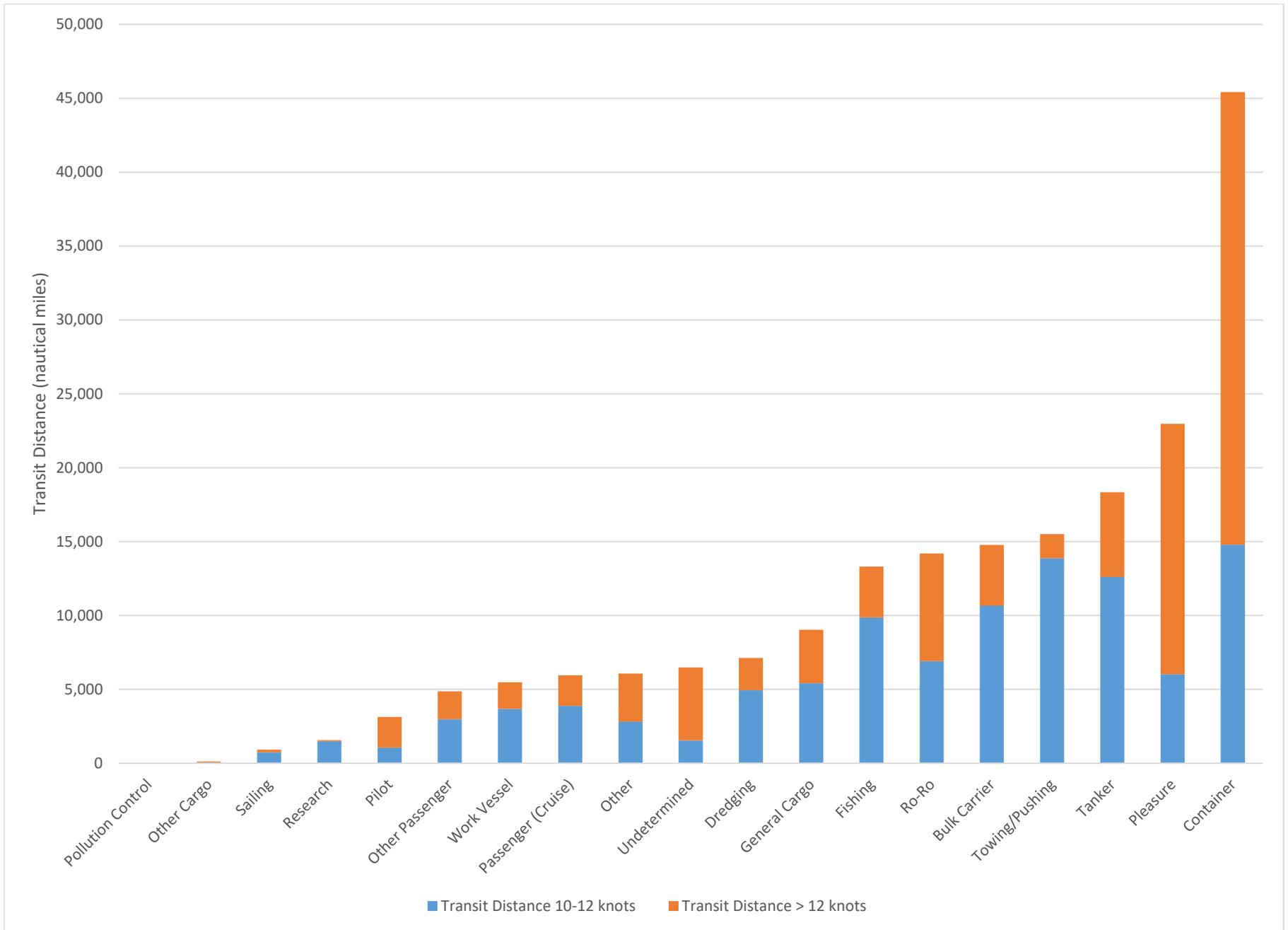


Figure 16. Total (non-compliant) transit distance by vessel type at speeds of 10-12 knots (blue) and in excess of 12 knots (orange) in SMAs during the 2018-2019 active season.

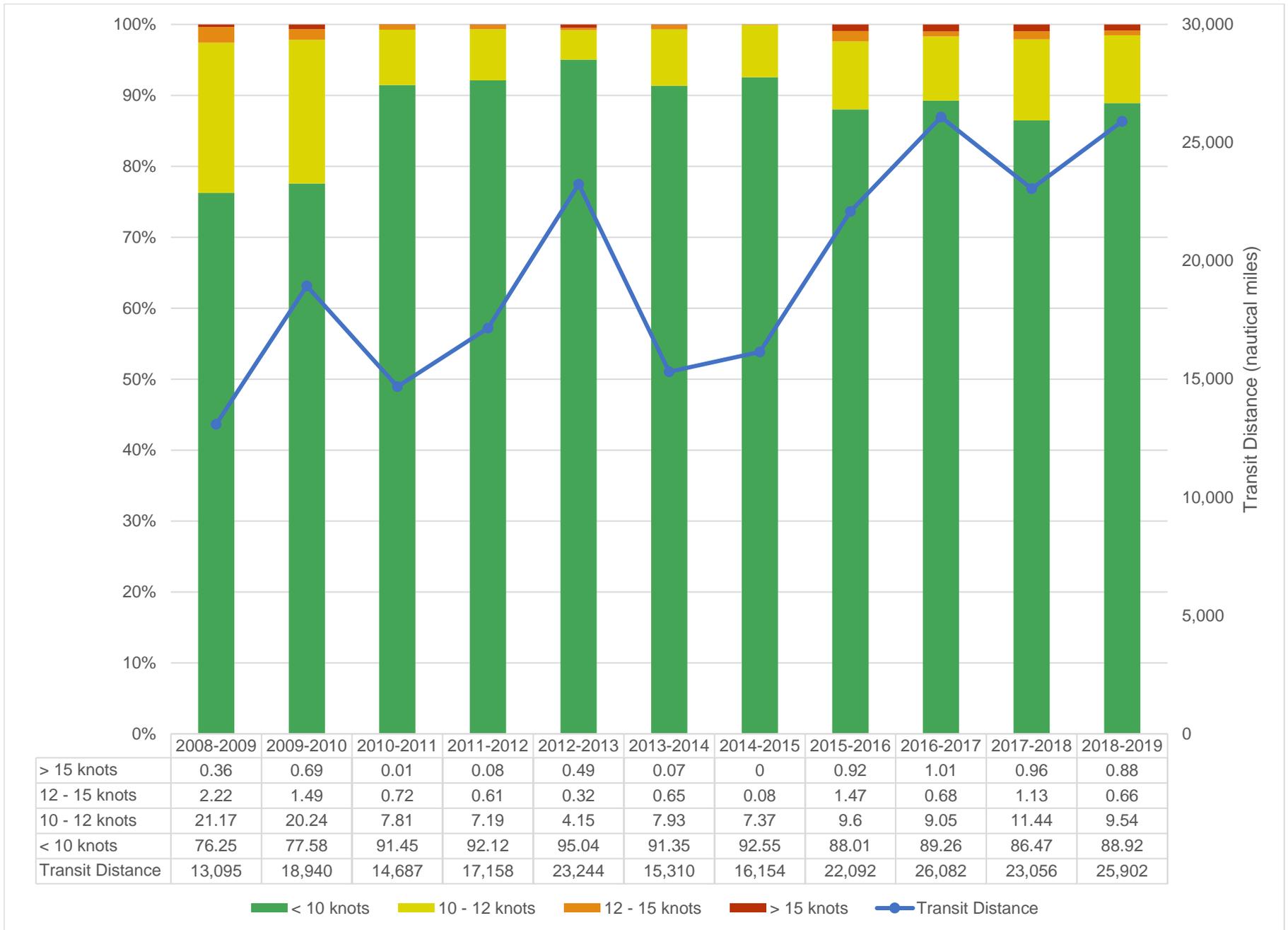


Figure 17. Proportion of total distance transited through the active Cape Cod Bay SMA by speed class each season. The blue line indicates the total distance transited each season.

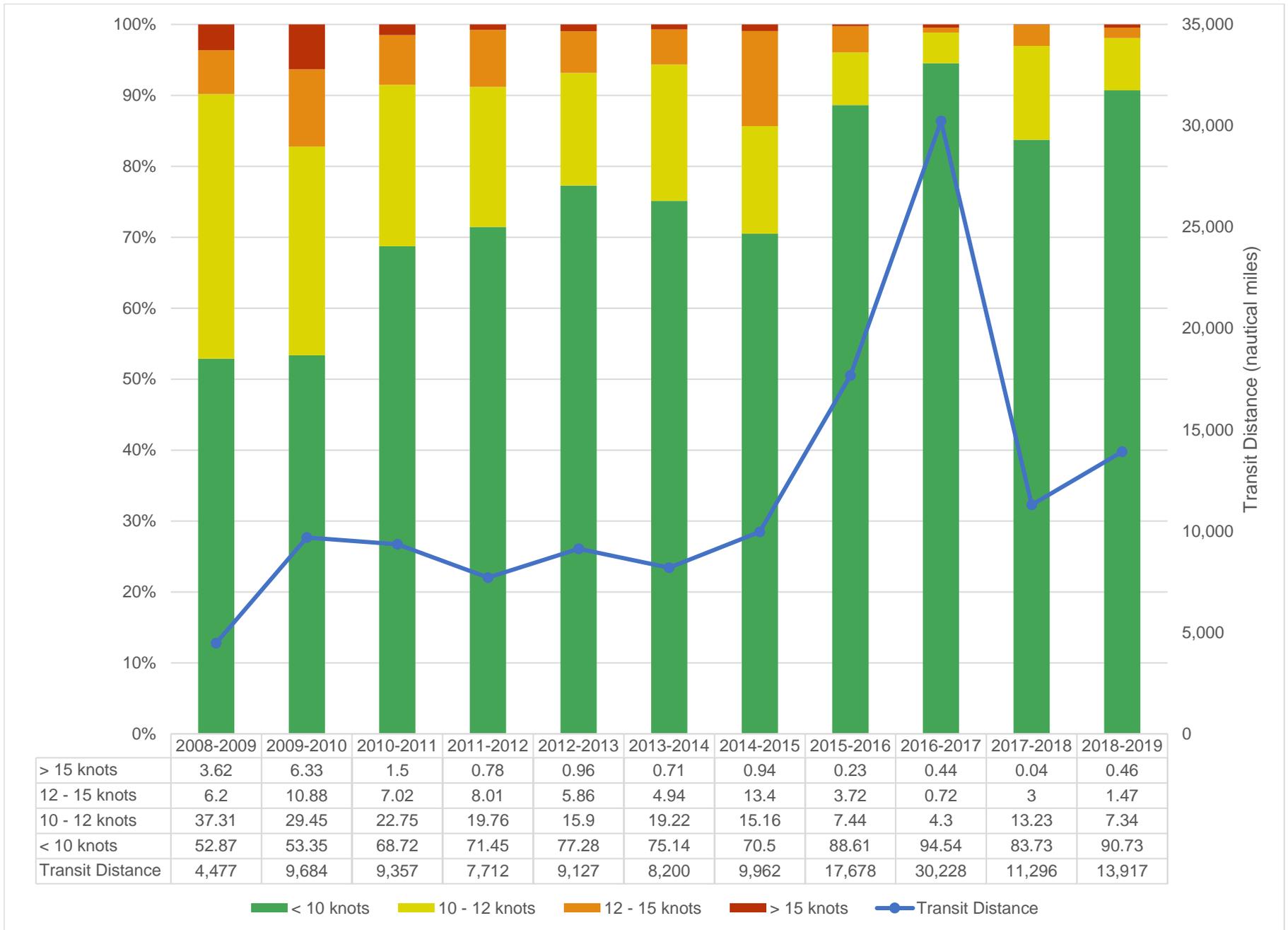


Figure 18. Proportion of total distance transited through the active Race Point SMA by speed class each season. The blue line indicates the total distance transited each season.

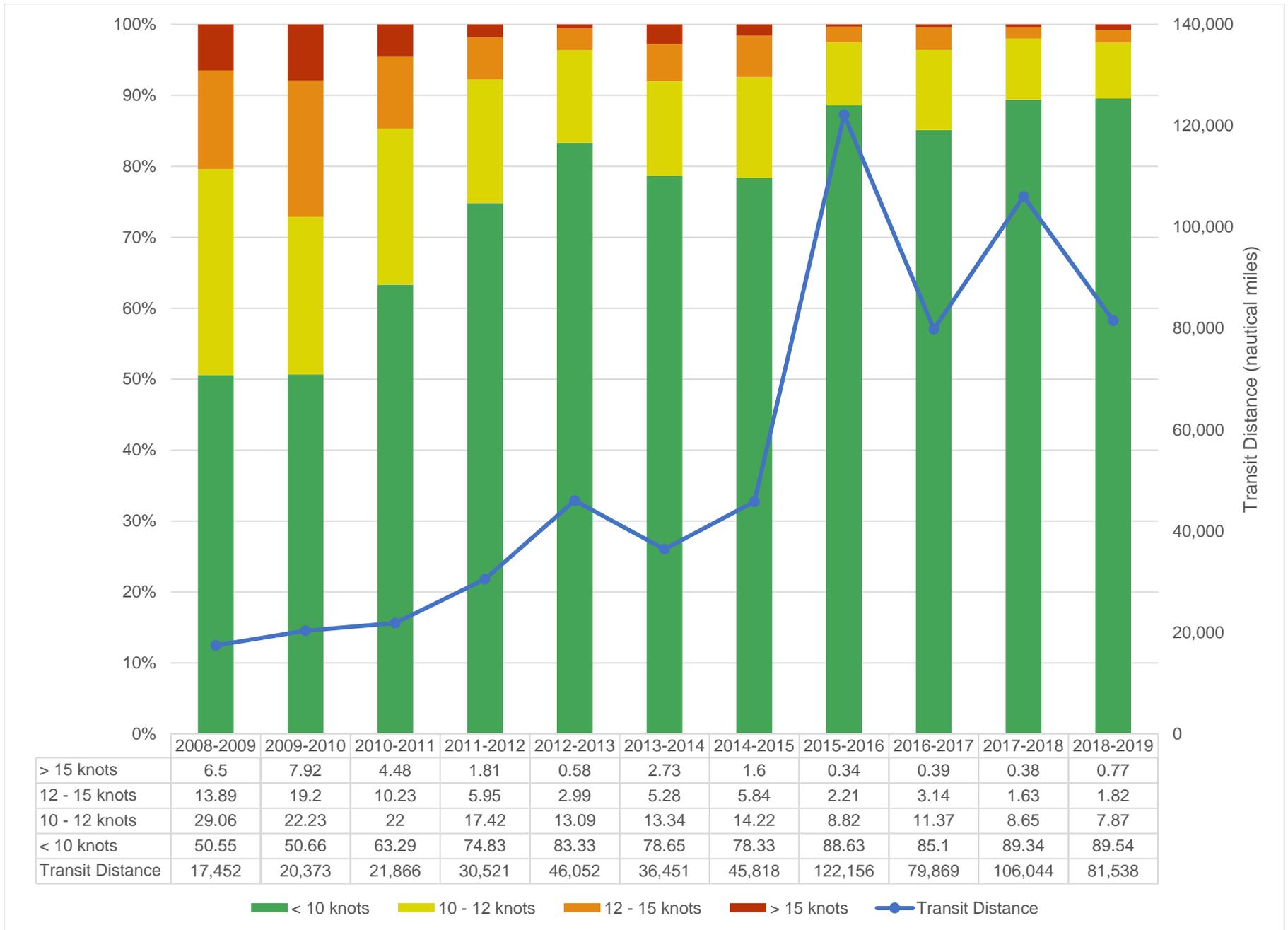


Figure 19. Proportion of total distance transited through the active Great South Channel SMA by speed class each season. The blue line indicates the total distance transited each season.

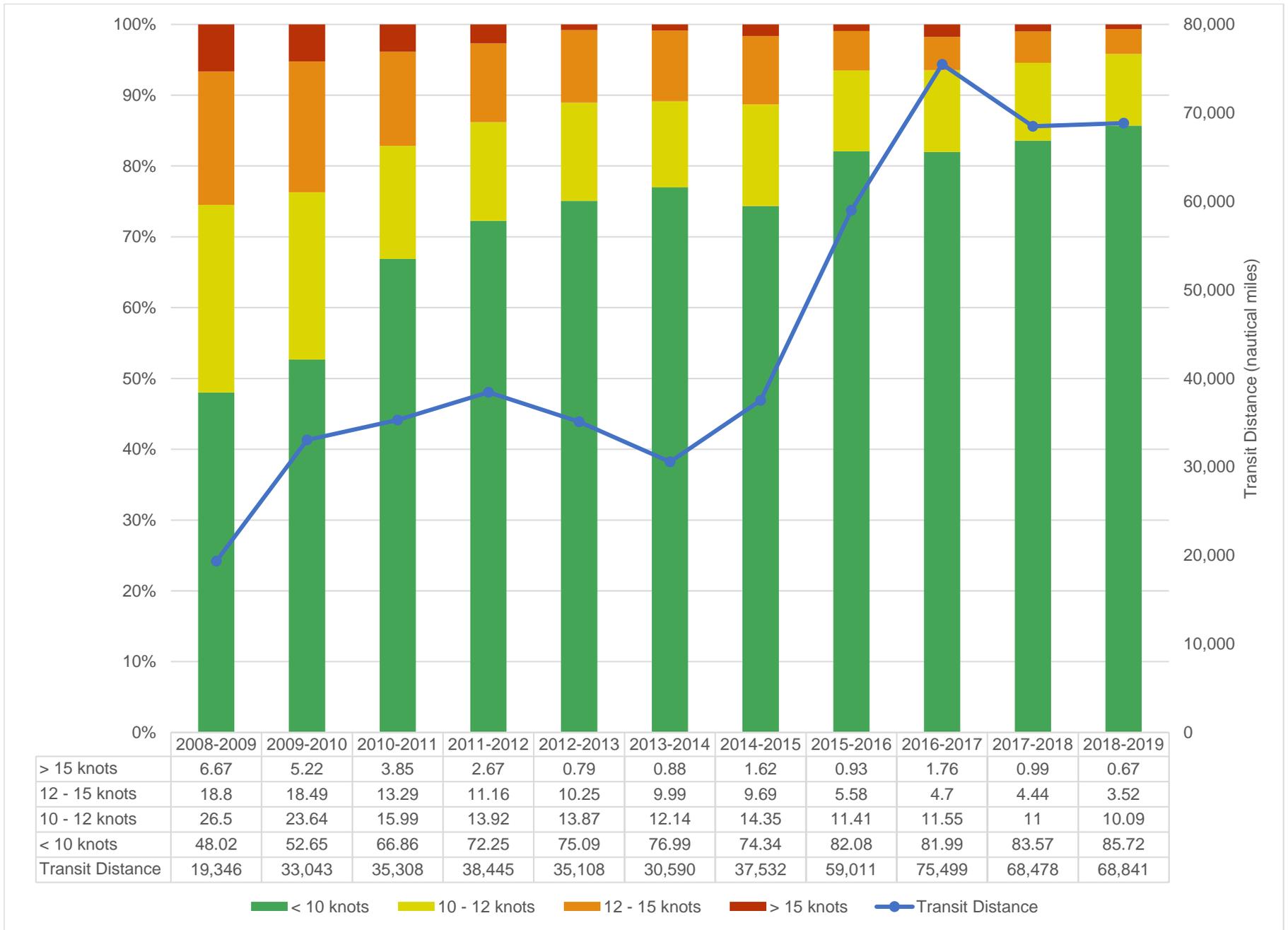


Figure 20. Proportion of total distance transited through the active Block Island SMA by speed class each season. The blue line indicates the total distance transited each season.

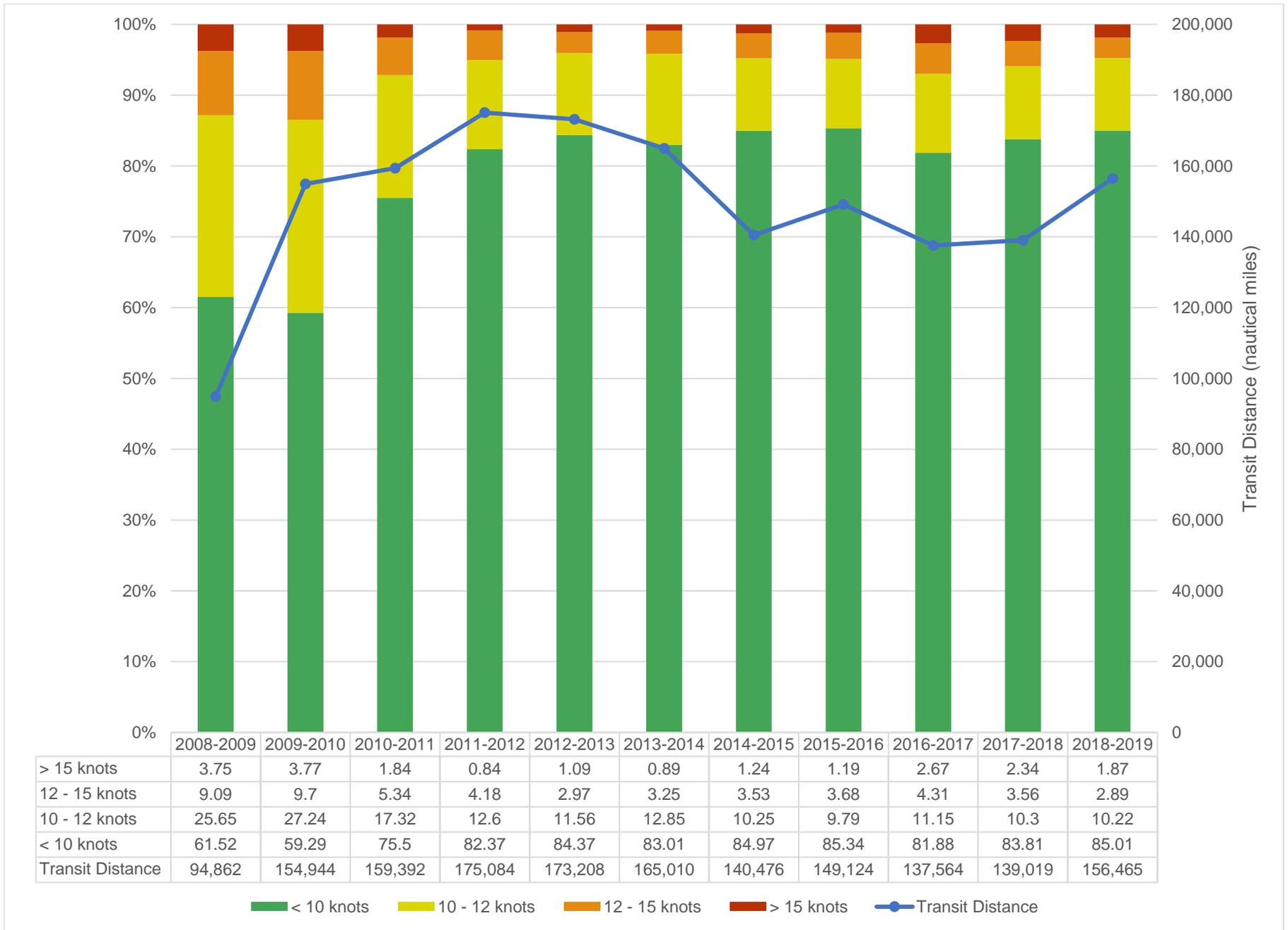


Figure 21. Proportion of total distance transited through the active New York SMA by speed class each season. The blue line indicates the total distance transited each season.

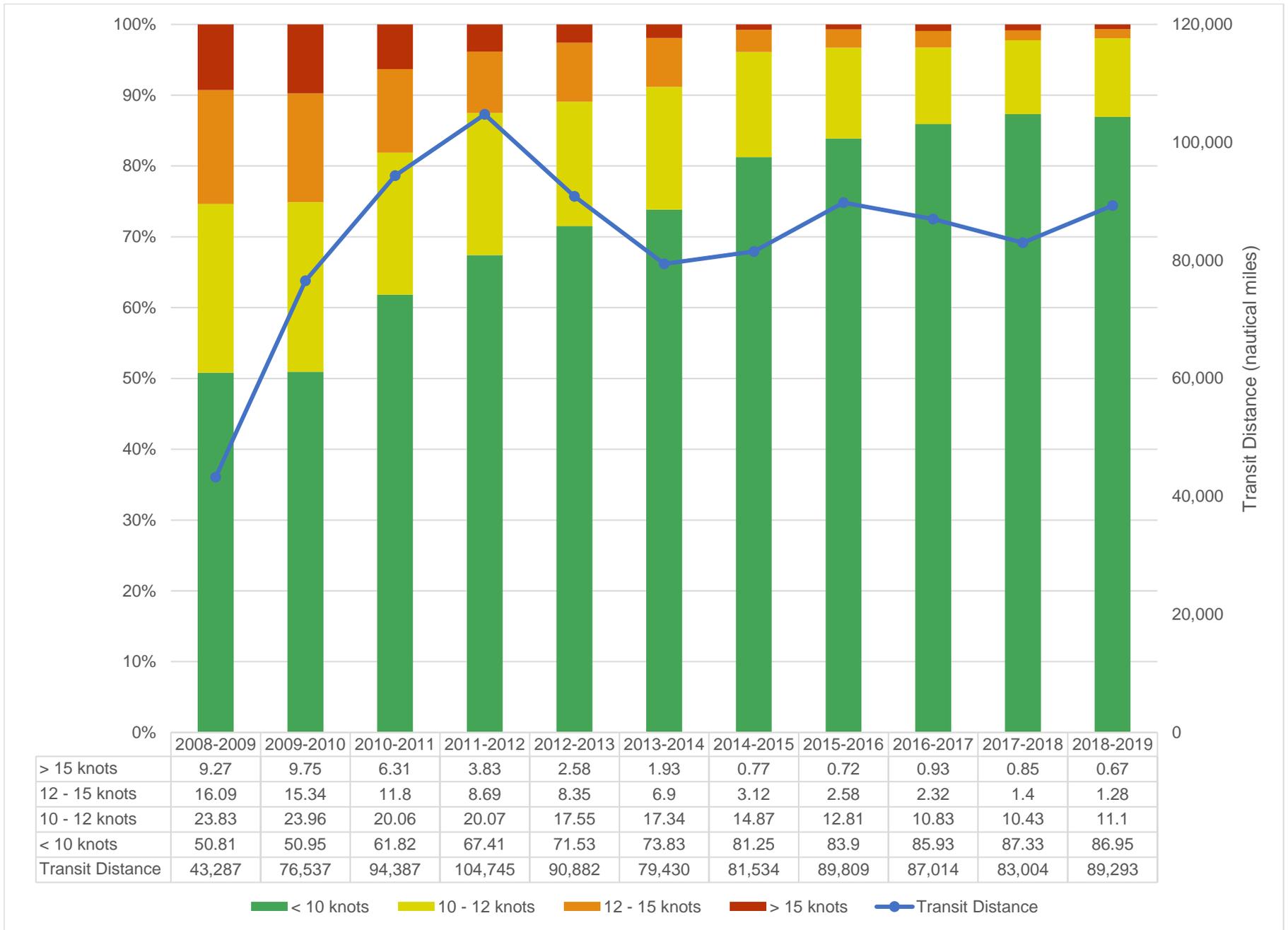


Figure 22. Proportion of total distance transited through the active Delaware bay SMA by speed class each season. The blue line indicates the total distance transited each season.

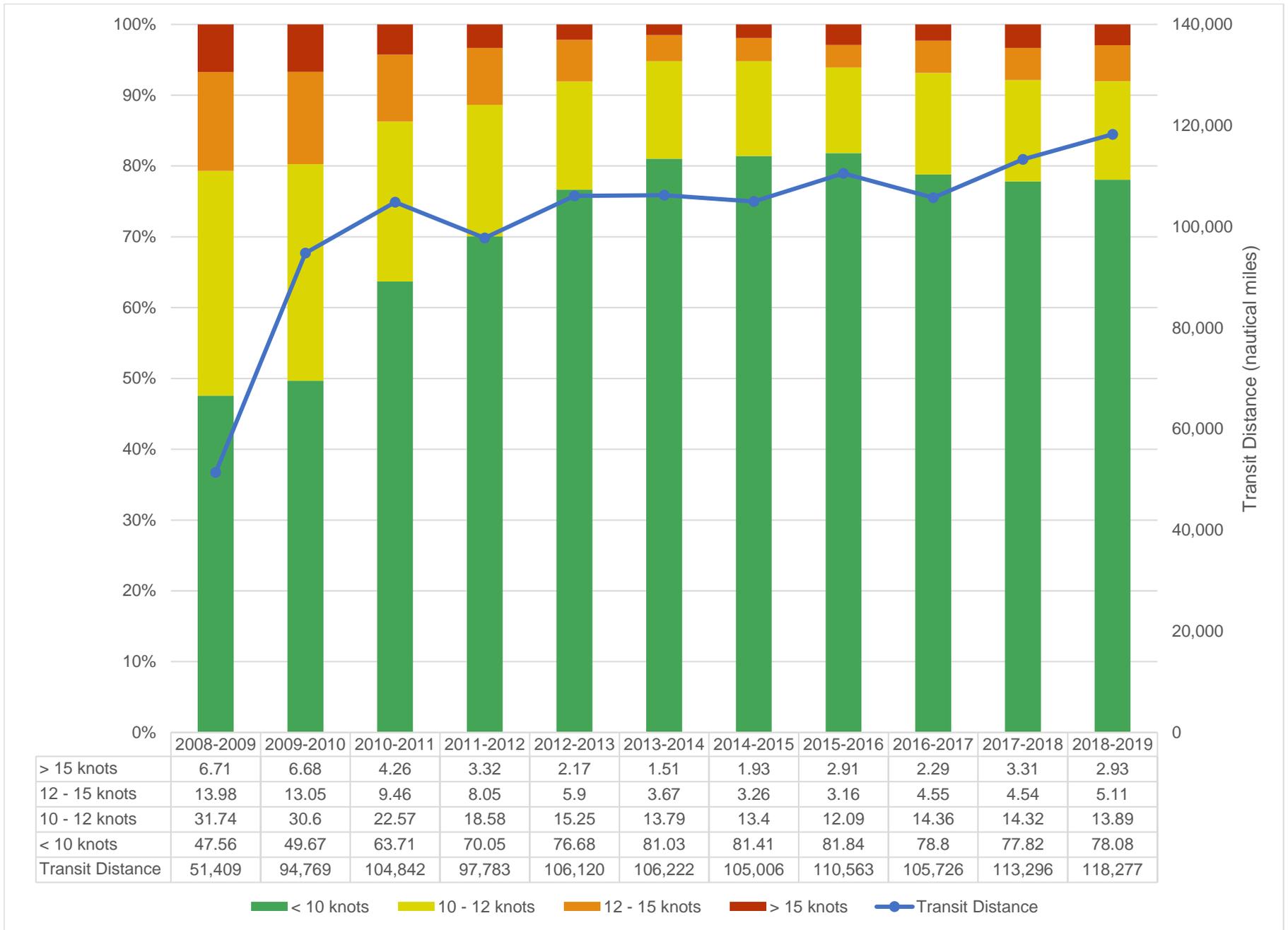


Figure 23. Proportion of total distance transited through the active Chesapeake SMA by speed class each season. The blue line indicates the total distance transited each season.

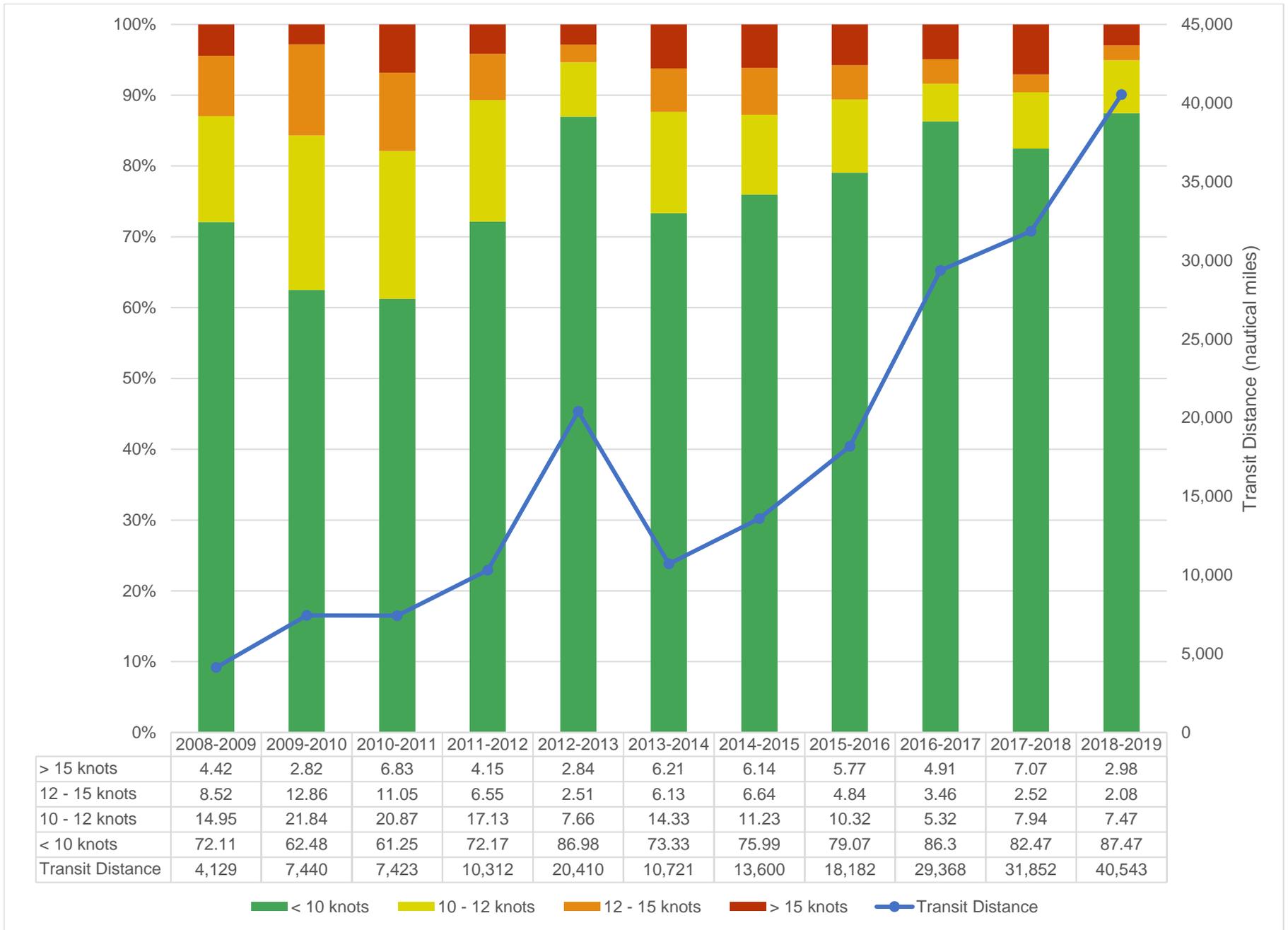


Figure 24. Proportion of total distance transited through the active Morehead City SMA by speed class each season. The blue line indicates the total distance transited each season.

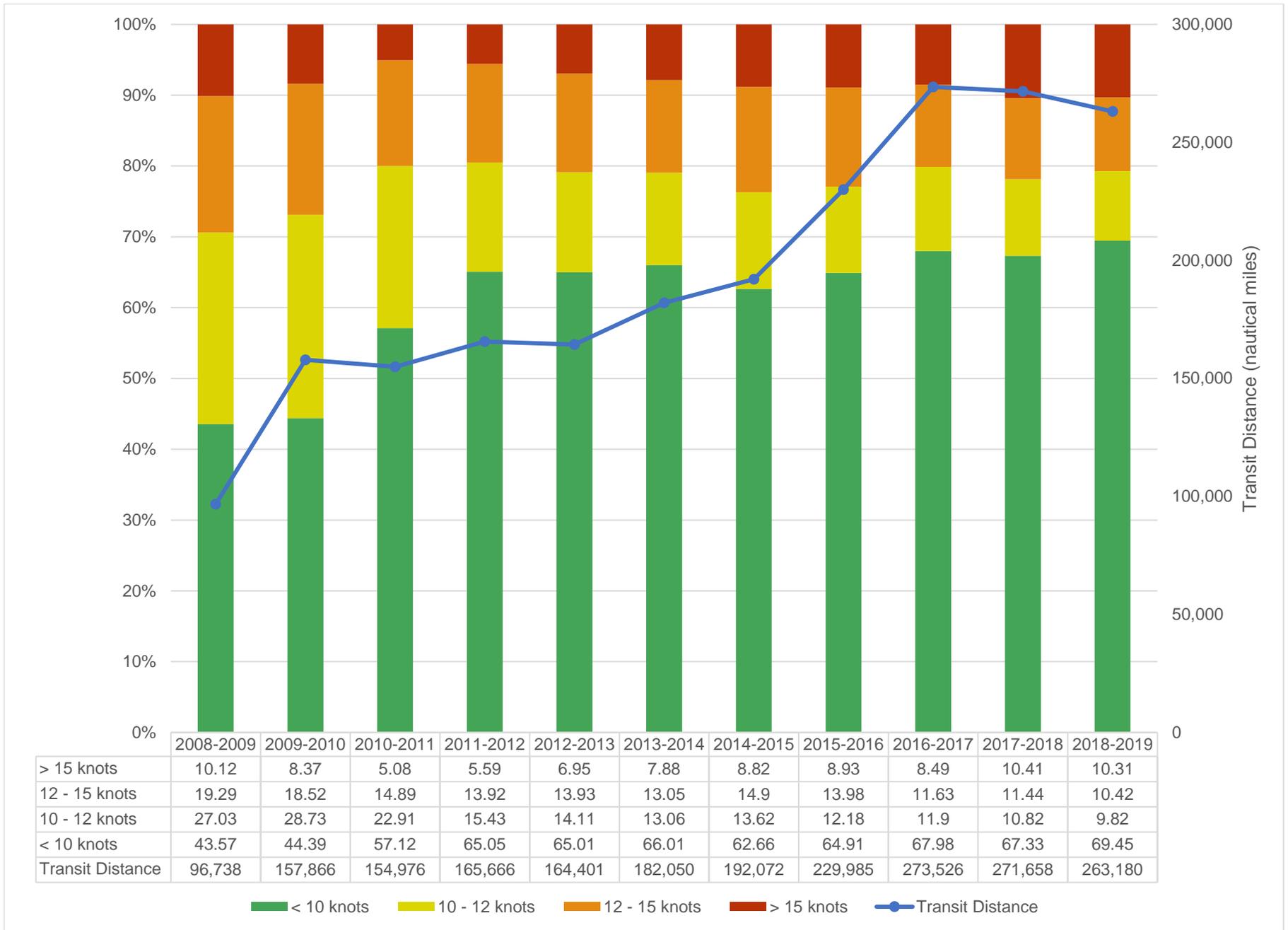


Figure 25. Proportion of total distance transited through the active North Carolina to Georgia SMA by speed class each season. The blue line indicates the total distance transited each season.

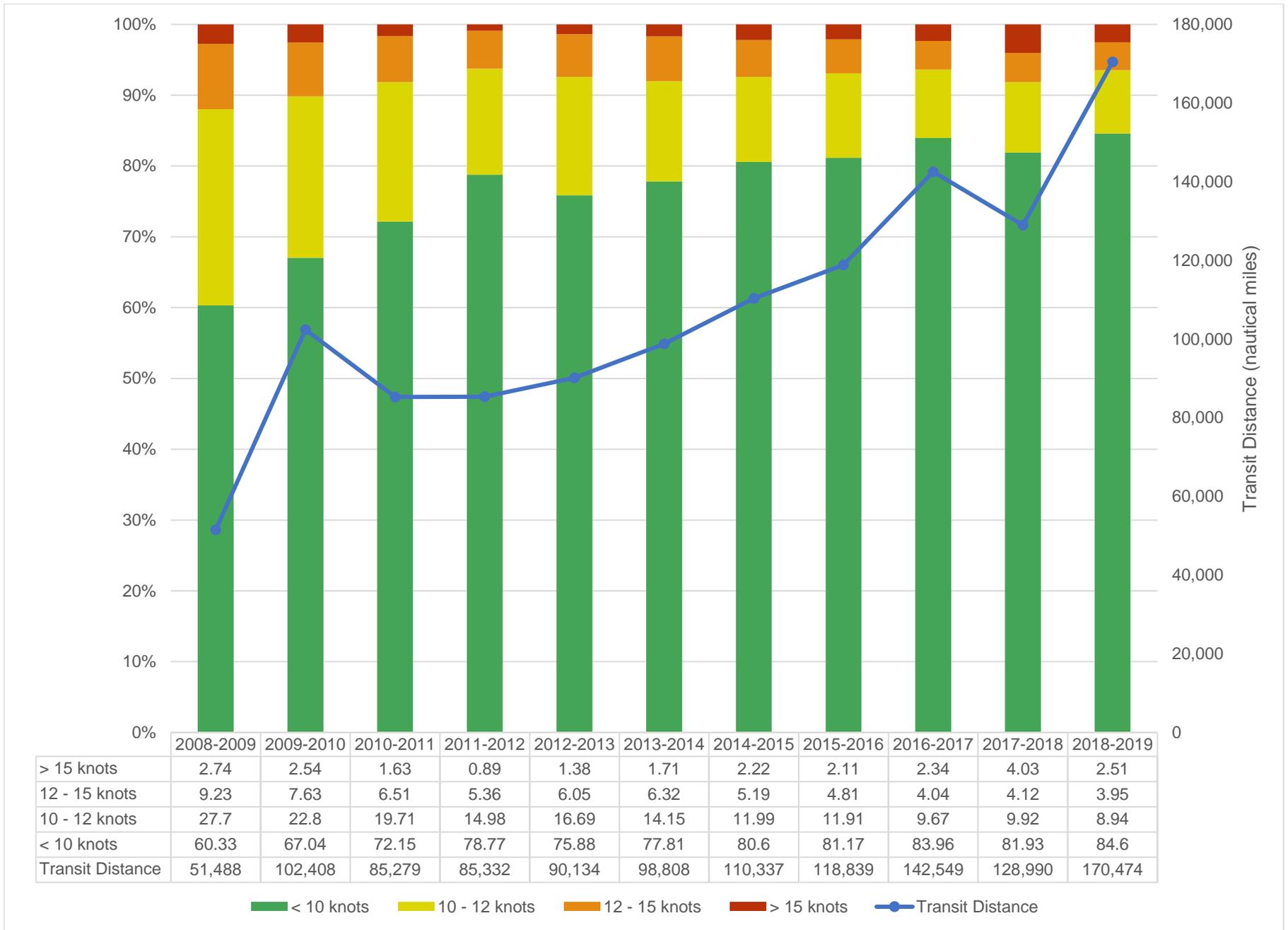


Figure 26. Proportion of total distance transited through the active Southeast SMA by speed class each season. The blue line indicates the total distance transited each season.

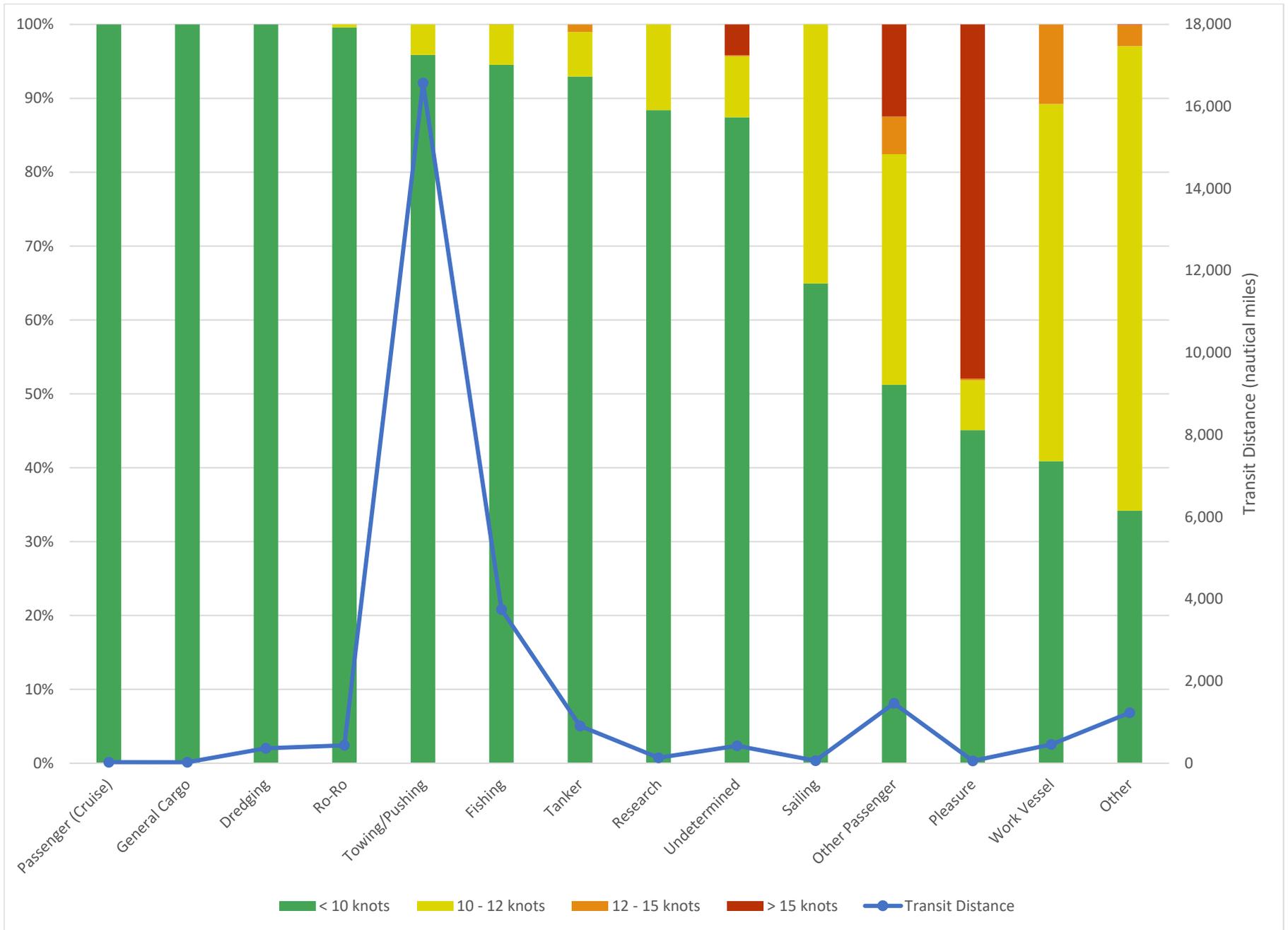


Figure 27. Proportion of total distance transited through the active Cape Cod Bay SMA by vessel type during the 2018-2019 season. The blue line indicates the total distance transited by each vessel type in the active SMA 2018-2019.

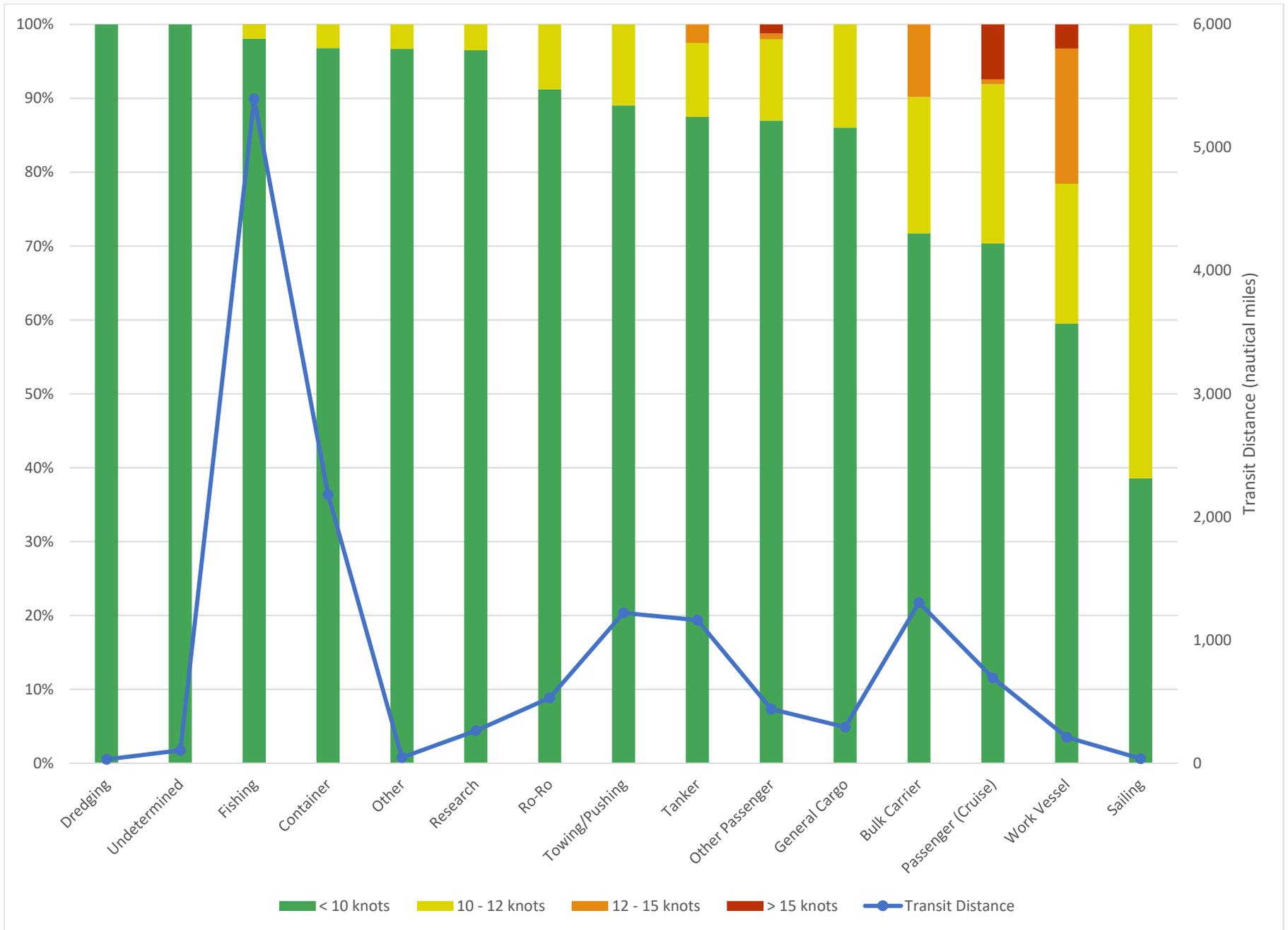


Figure 28. Proportion of total distance transited through the active Race Point SMA by vessel type during the 2018-2019 season. The blue line indicates the total distance transited by each vessel type in the active SMA 2018-2019.

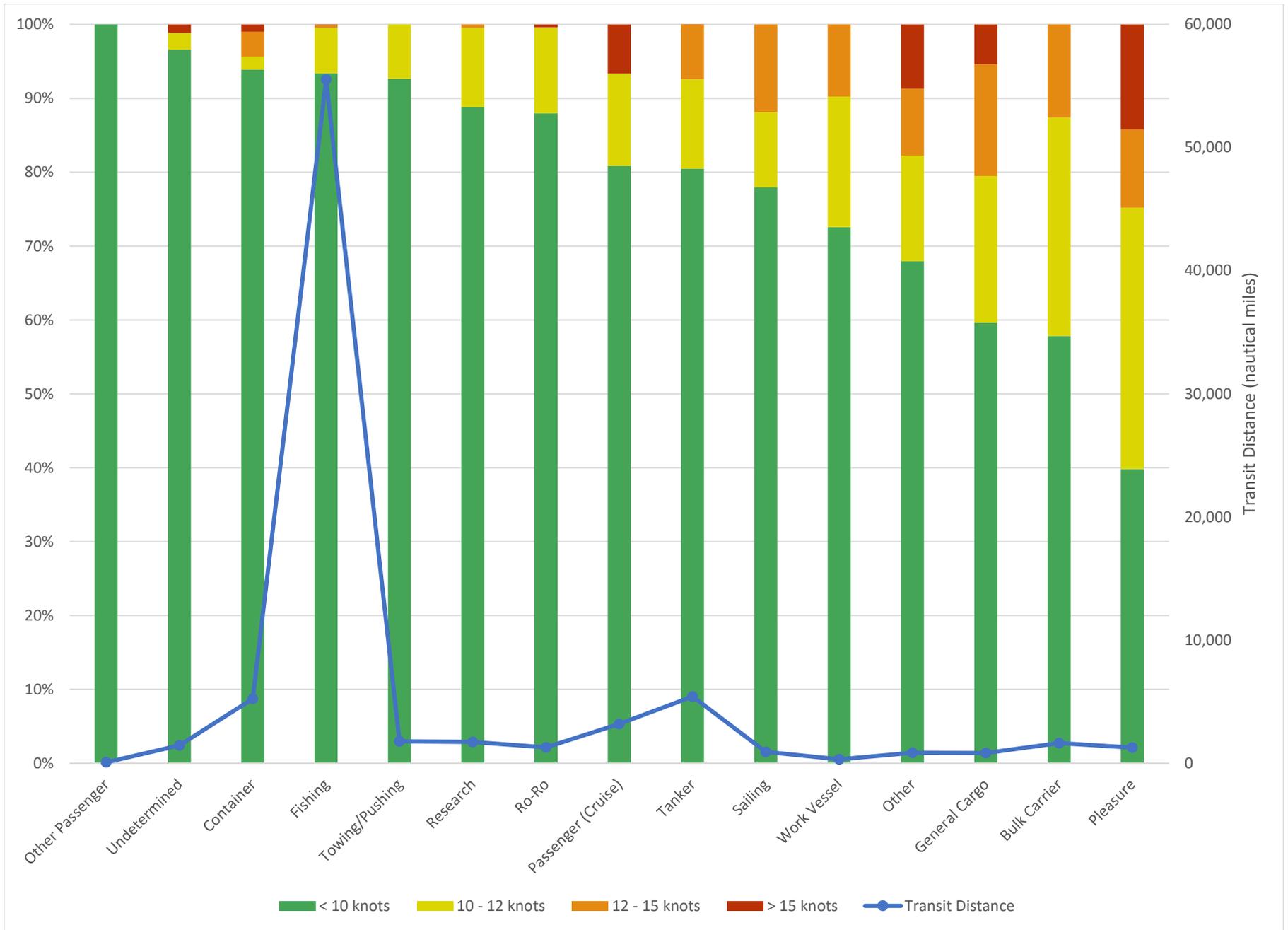


Figure 29. Proportion of total distance transited through the active Great South Channel SMA by vessel type during the 2018-2019 season. The blue line indicates the total distance transited by each vessel type in the active SMA 2018-2019.

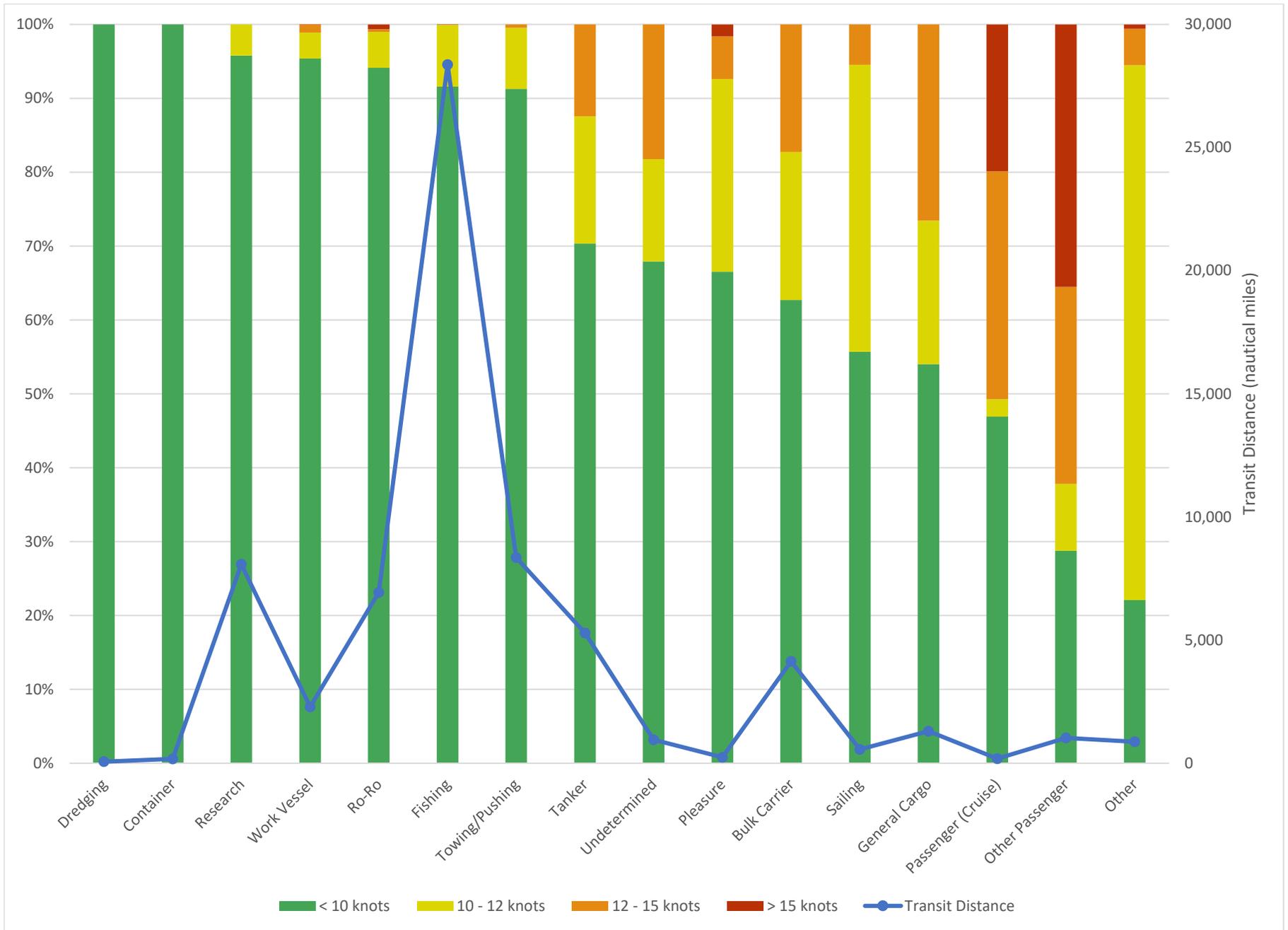


Figure 30. Proportion of total distance transited through the active Block Island SMA by vessel type during the 2018-2019 season. The blue line indicates the total distance transited by each vessel type in the active SMA 2018-2019.

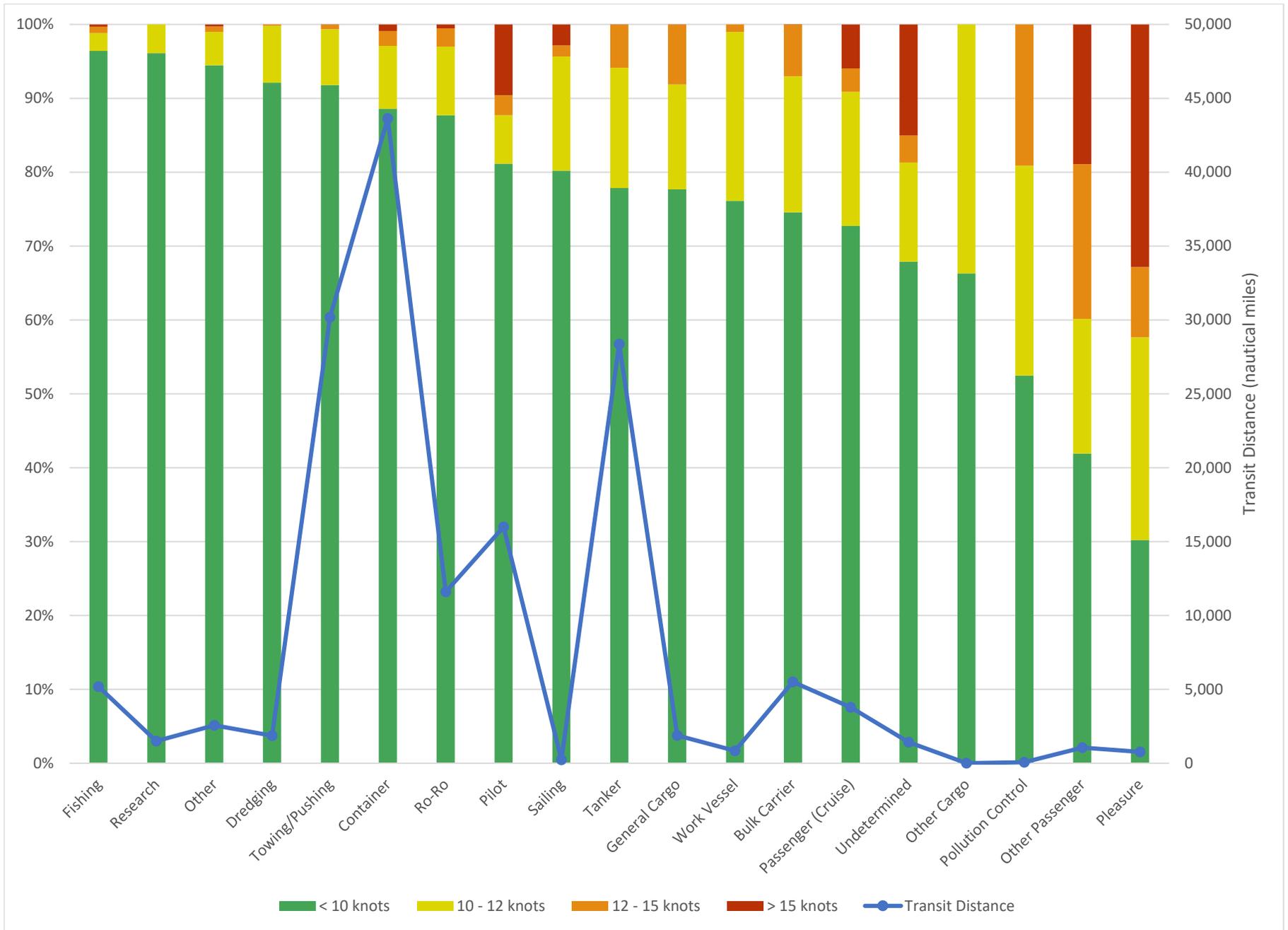


Figure 31. Proportion of total distance transited through the active New York SMA by vessel type during the 2018-2019 season. The blue line indicates the total distance transited by each vessel type in the active SMA 2018-2019.

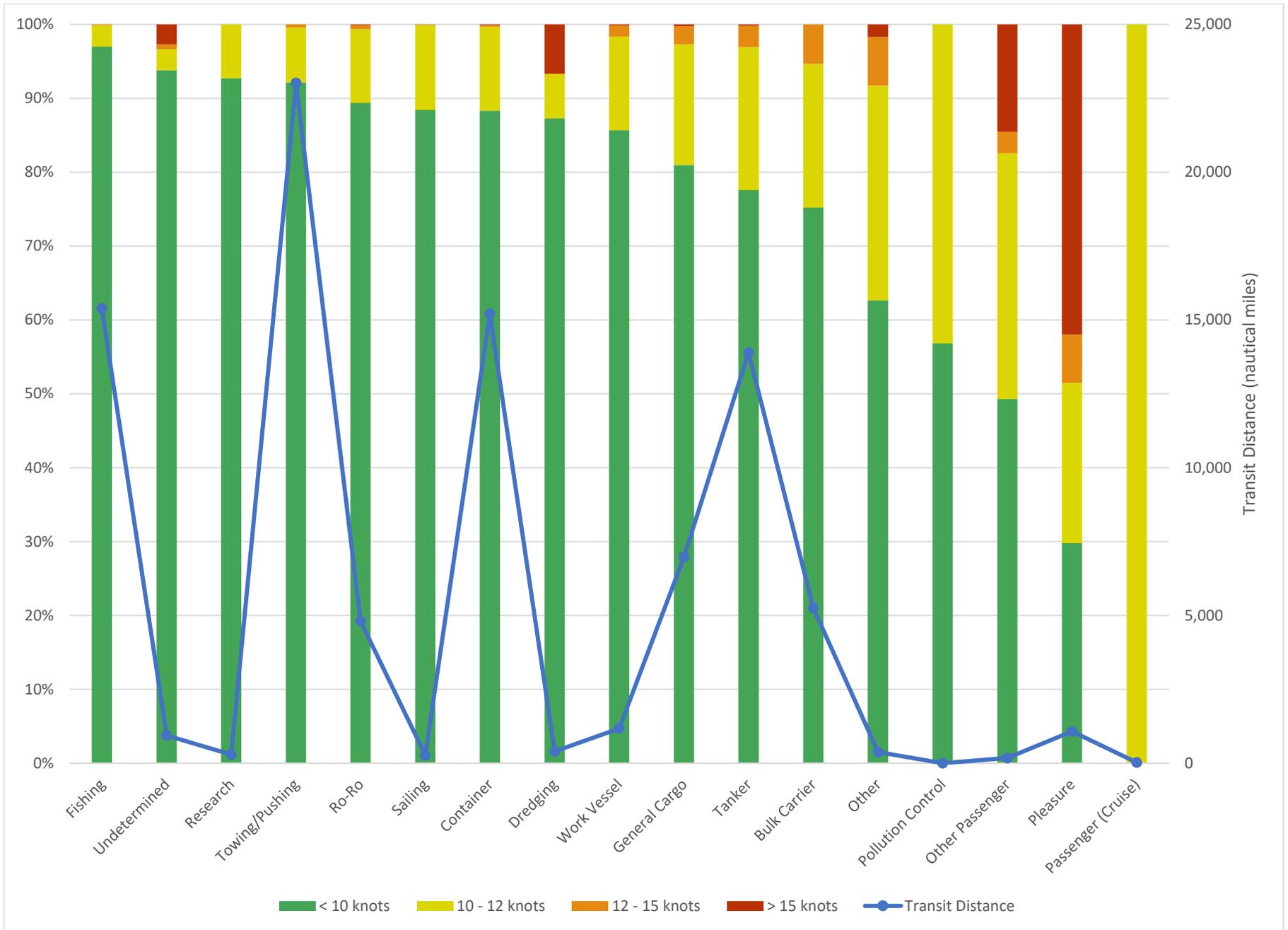


Figure 32. Proportion of total distance transited through the active Delaware Bay SMA by vessel type during the 2018-2019 season. The blue line indicates the total distance transited by each vessel type in the active SMA 2018-2019.

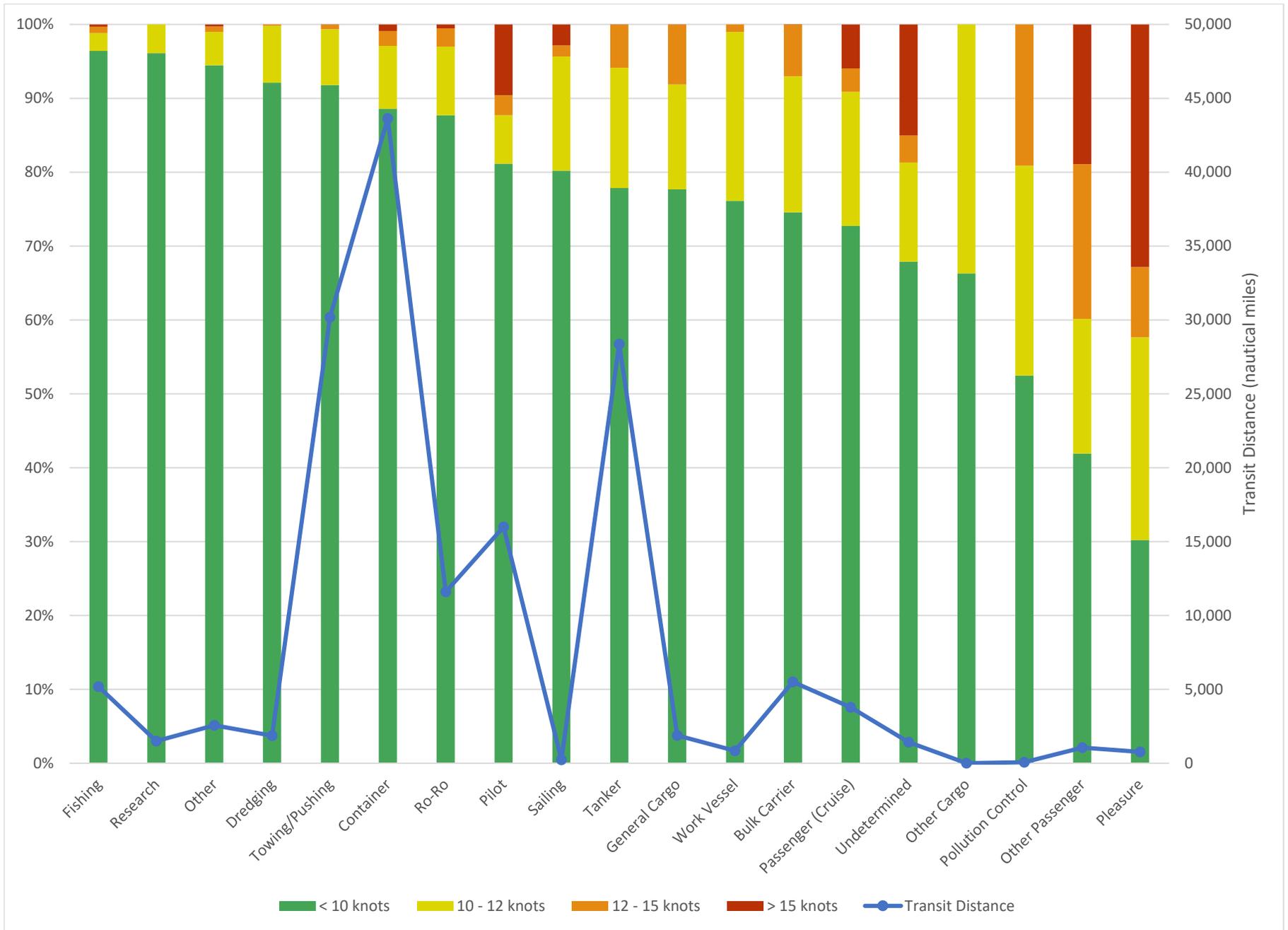


Figure 33. Proportion of total distance transited through the active Chesapeake SMA by vessel type during the 2018-2019 season. The blue line indicates the total distance transited by each vessel type in the active SMA 2018-2019.

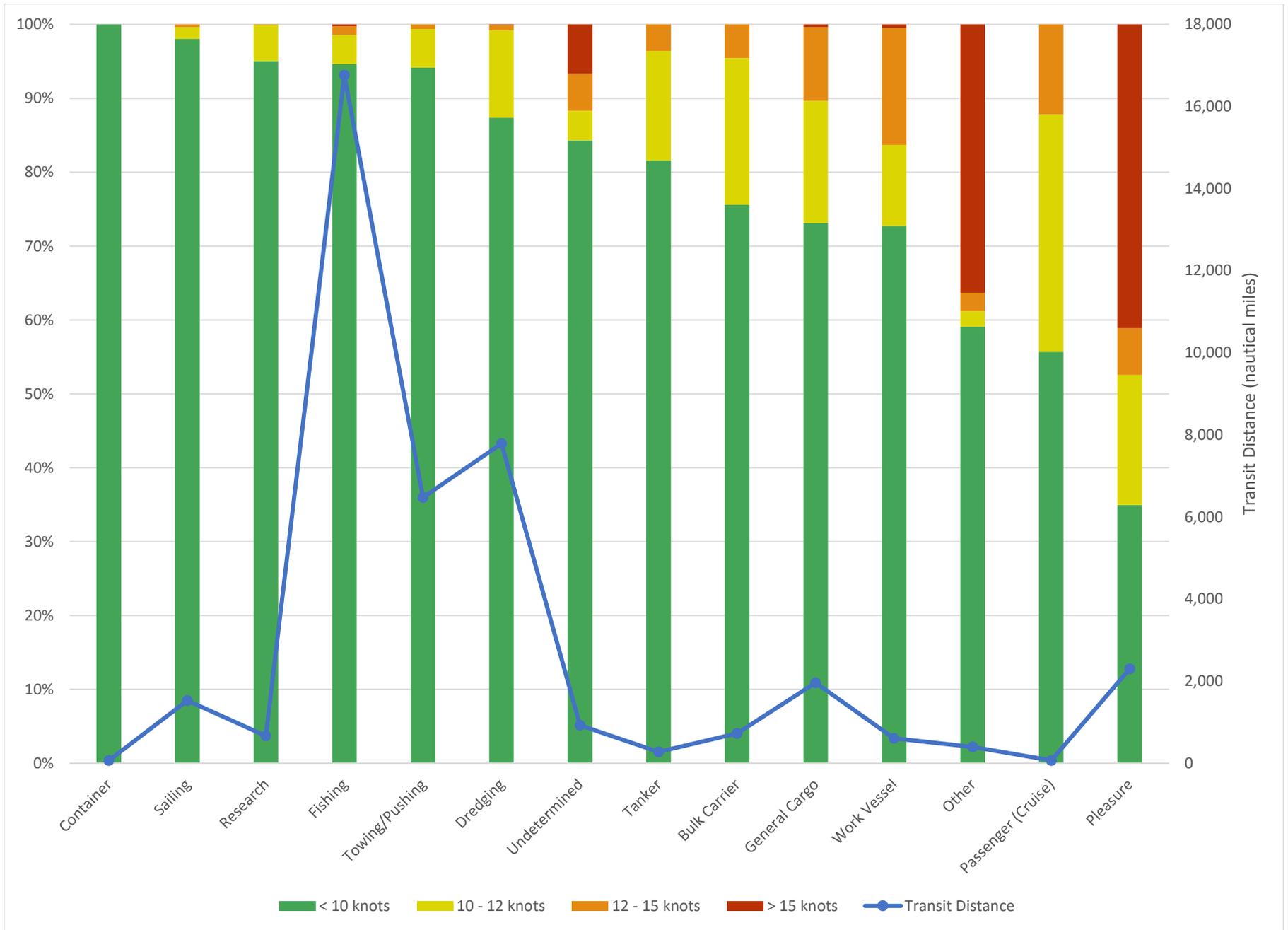


Figure 34. Proportion of total distance transited through the active Morehead City SMA by vessel type during the 2018-2019 season. The blue line indicates the total distance transited by each vessel type in the active SMA 2018-2019.

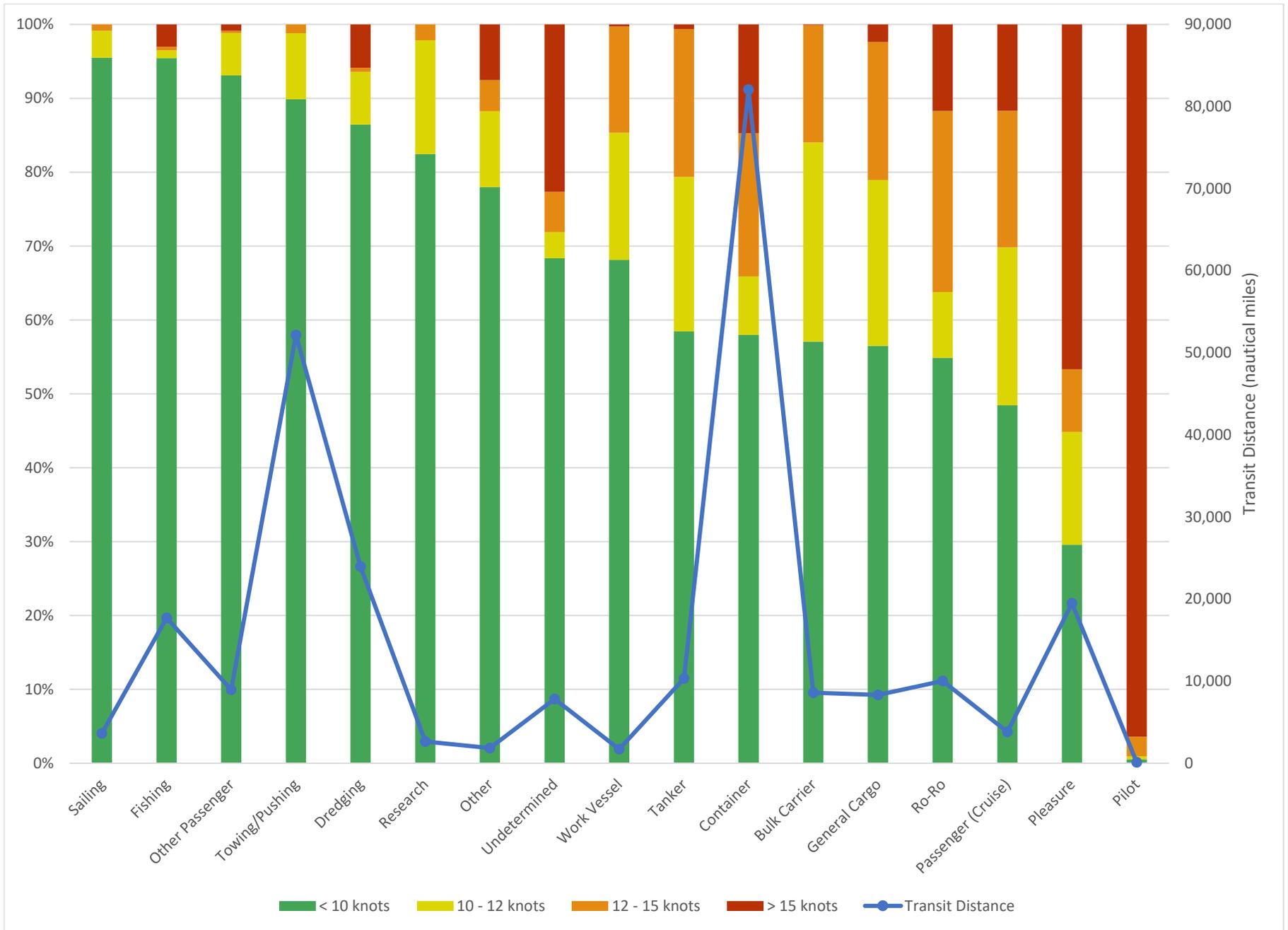


Figure 35. Proportion of total distance transited through the active North Carolina to Georgia SMA by vessel type during the 2018-2019 season. The blue line indicates the total distance transited by each vessel type in the active SMA 2018-2019.

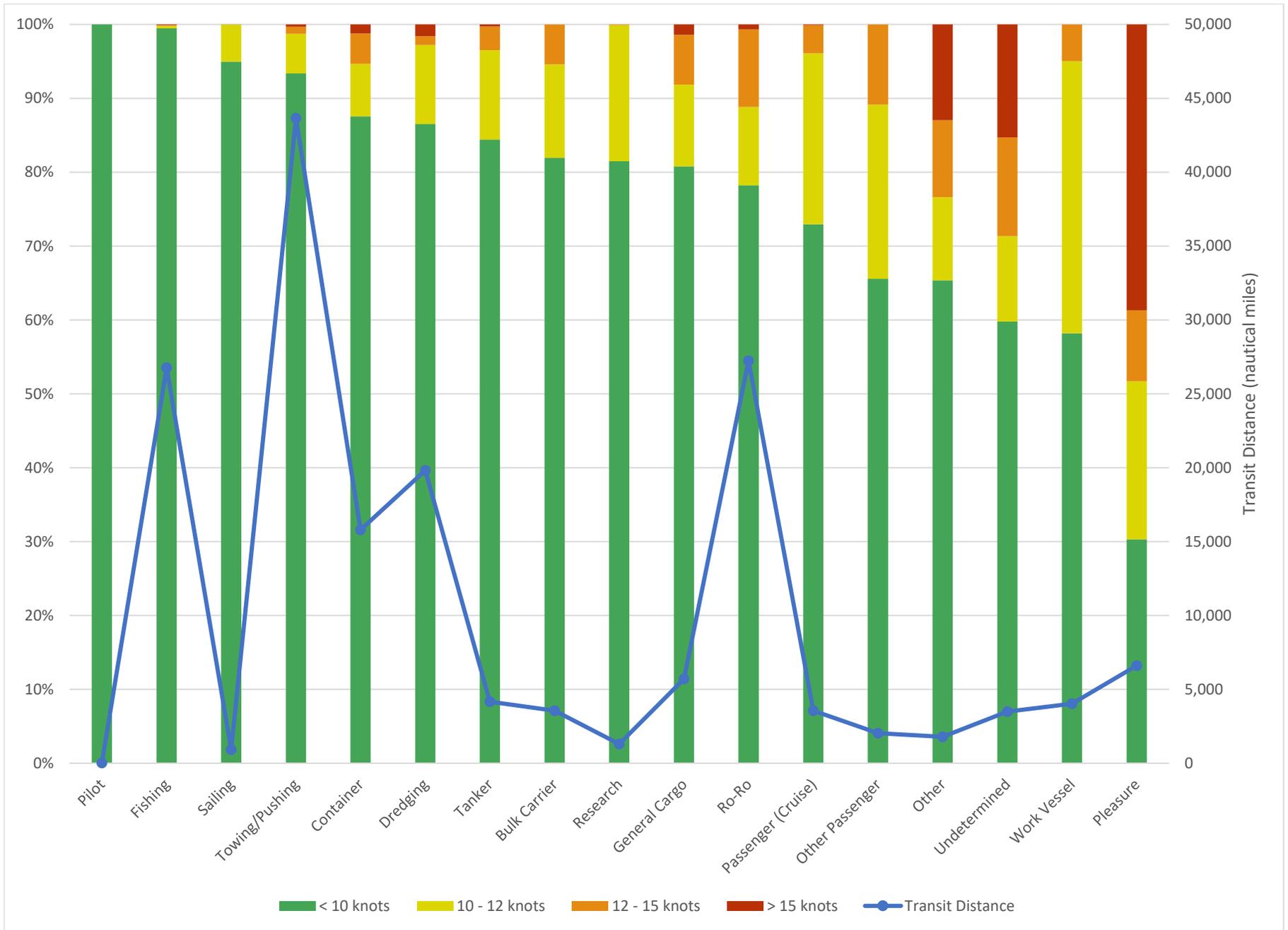


Figure 36. Proportion of total distance transited through the active Southeast SMA by vessel type during the 2018-2019 season. The blue line indicates the total distance transited by each vessel type in the active SMA 2018-2019.



Figure 37. Port Entrance Zones

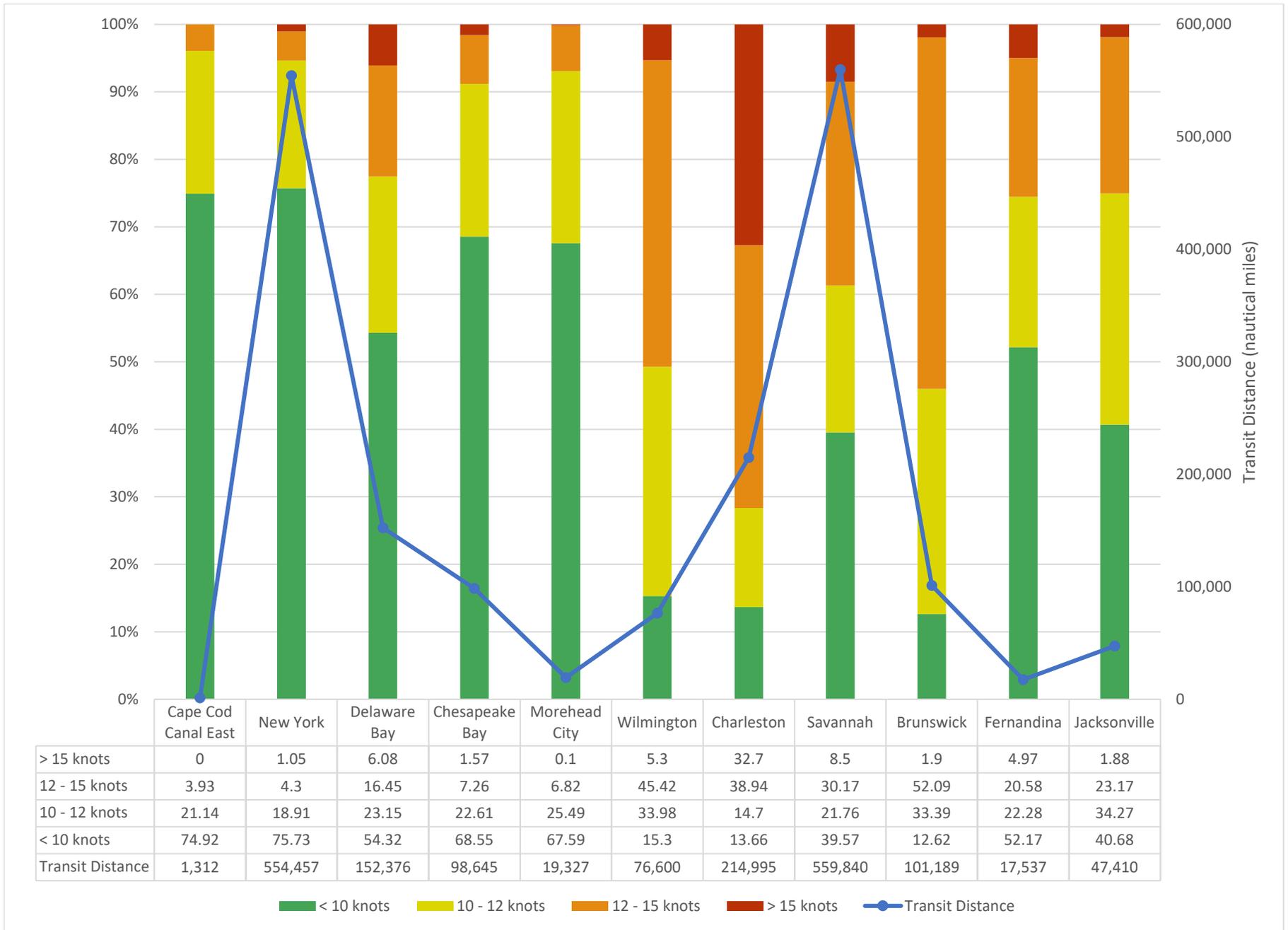


Figure 38. Proportion of total distance transited by OGVs through each active Entrance Zone by speed class across all seasons. The blue line indicates the total distance transited by OGVs in each SMA.

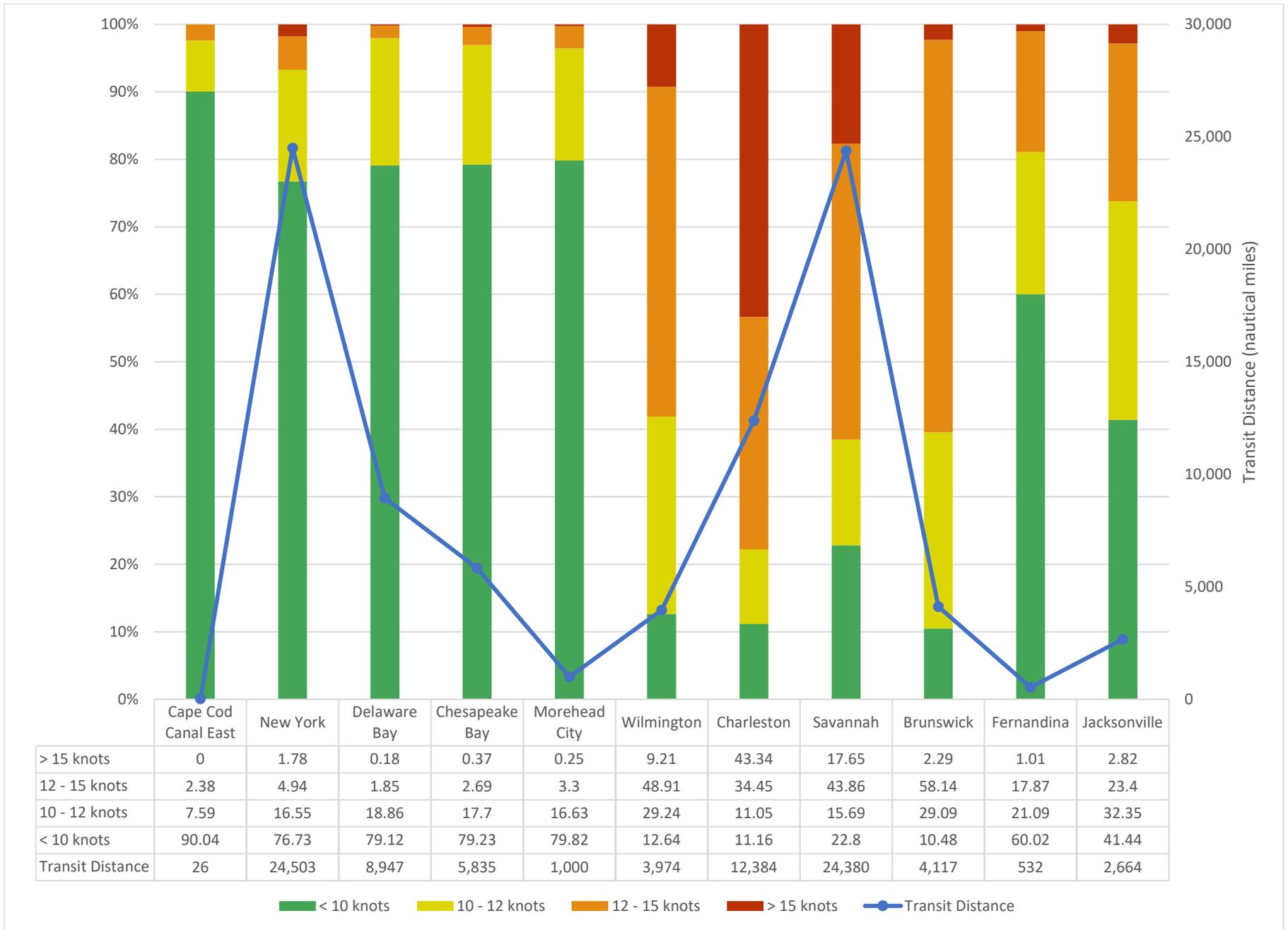


Figure 39. Proportion of total distance transited by OGVs through each active Entrance Zone by speed class in the 2018-2019 season. The blue line indicates the total distance transited by OGVs in each SMA during 2018-2019.



Figure 40. Proportion of total distance transited by OGVs through the Cape Cod Canal East Entrance Zone by speed class. The blue line indicates the total distance transited by OGVs.

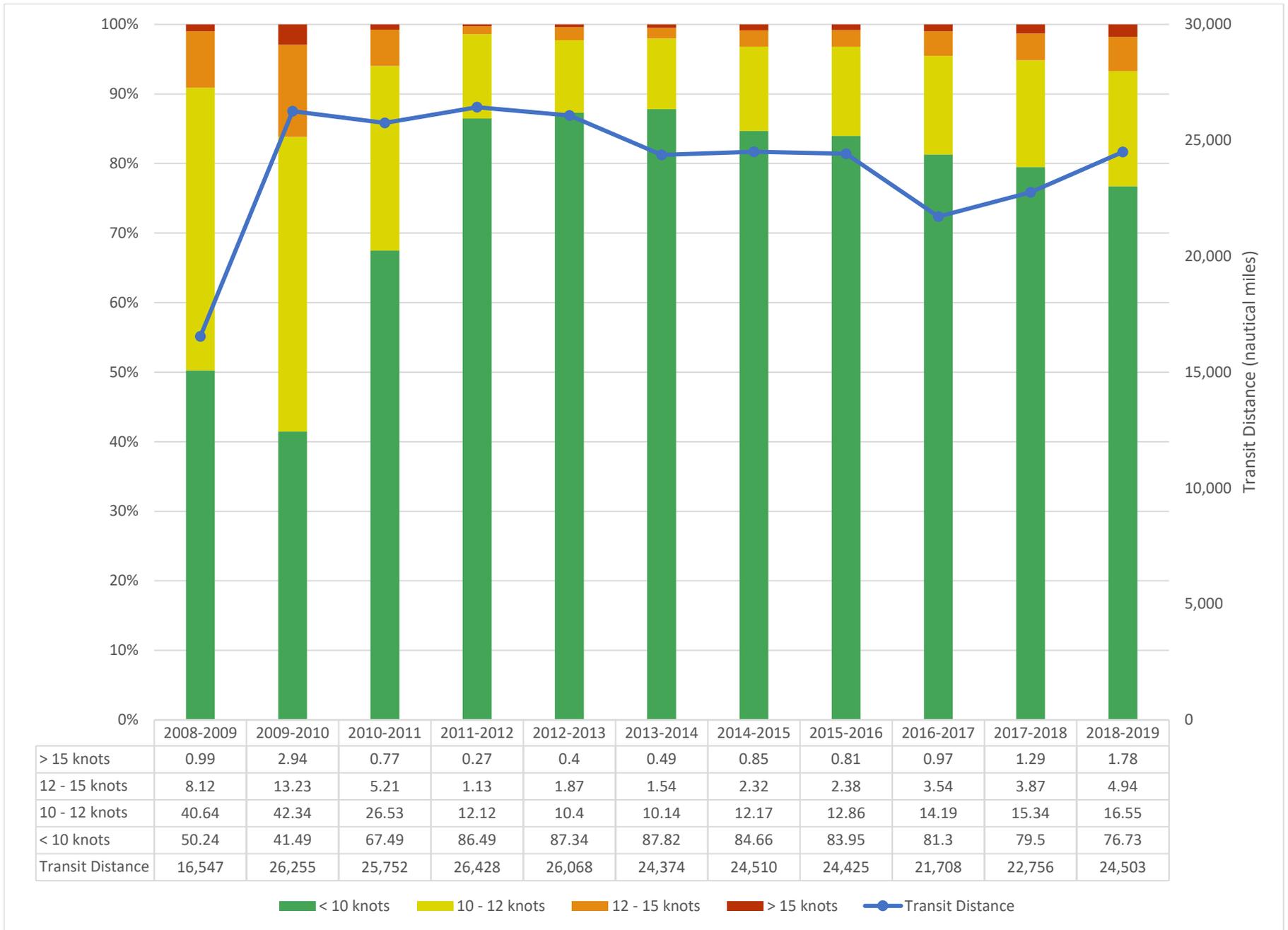


Figure 41. Proportion of total distance transited by OGVs through the New York Entrance Zone by speed class. The blue line indicates the total distance transited by OGVs.

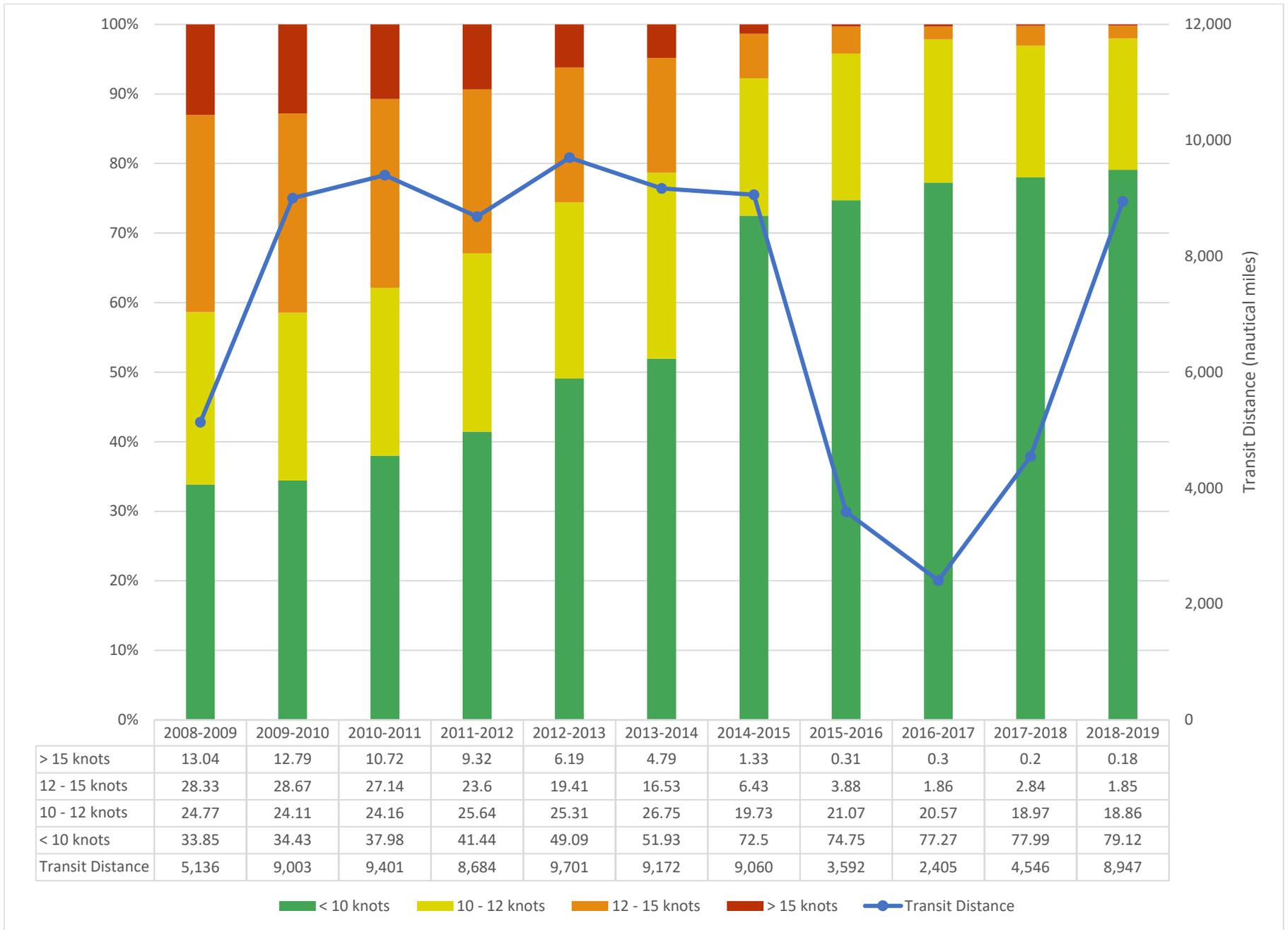


Figure 42. Proportion of total distance transited by OGVs through the Delaware Bay Entrance Zone by speed class. The blue line indicates the total distance transited by OGVs.

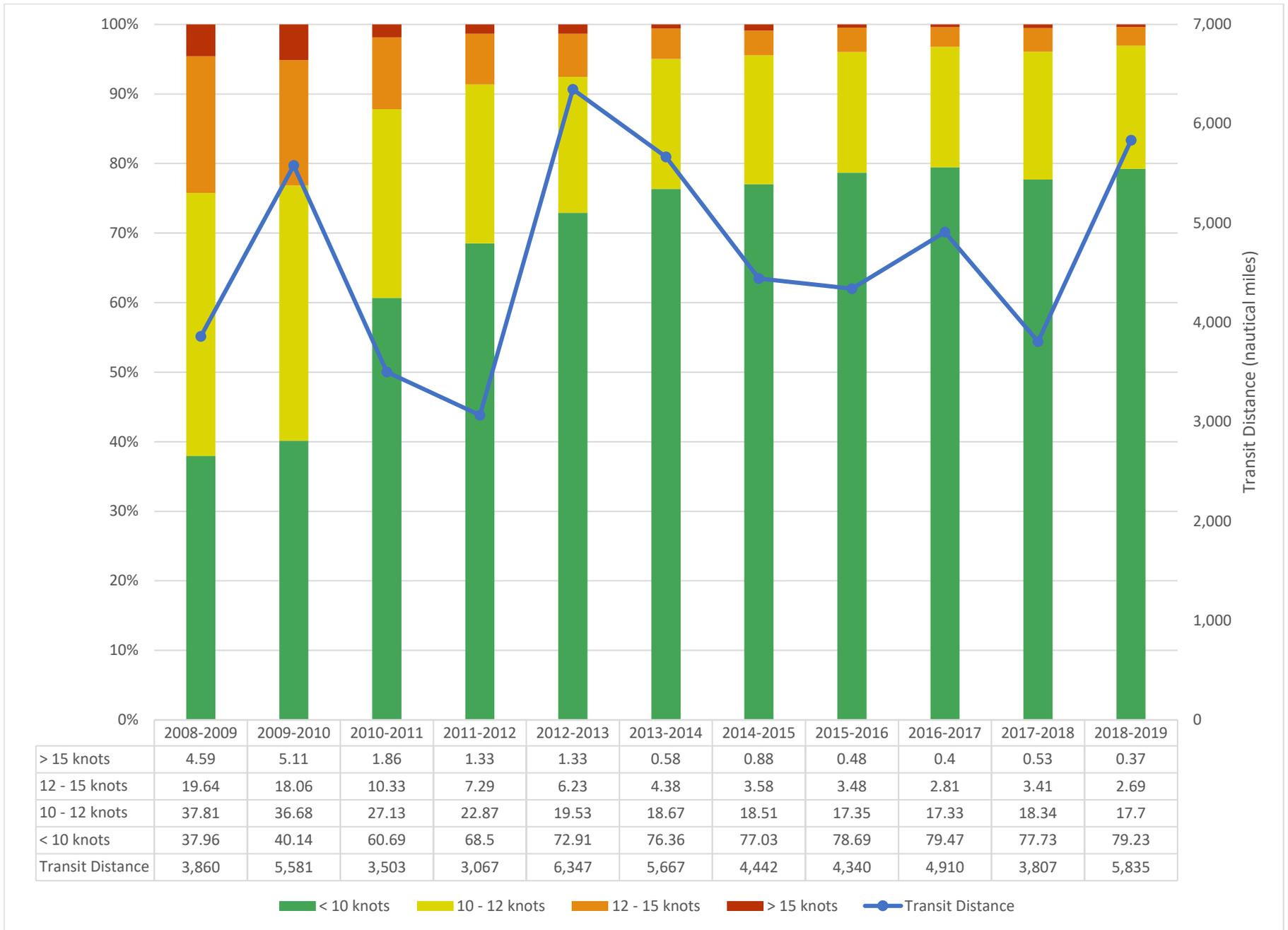


Figure 43. Proportion of total distance transited by OGVs through the Chesapeake Bay Entrance Zone by speed class. The blue line indicates the total distance transited by OGVs.

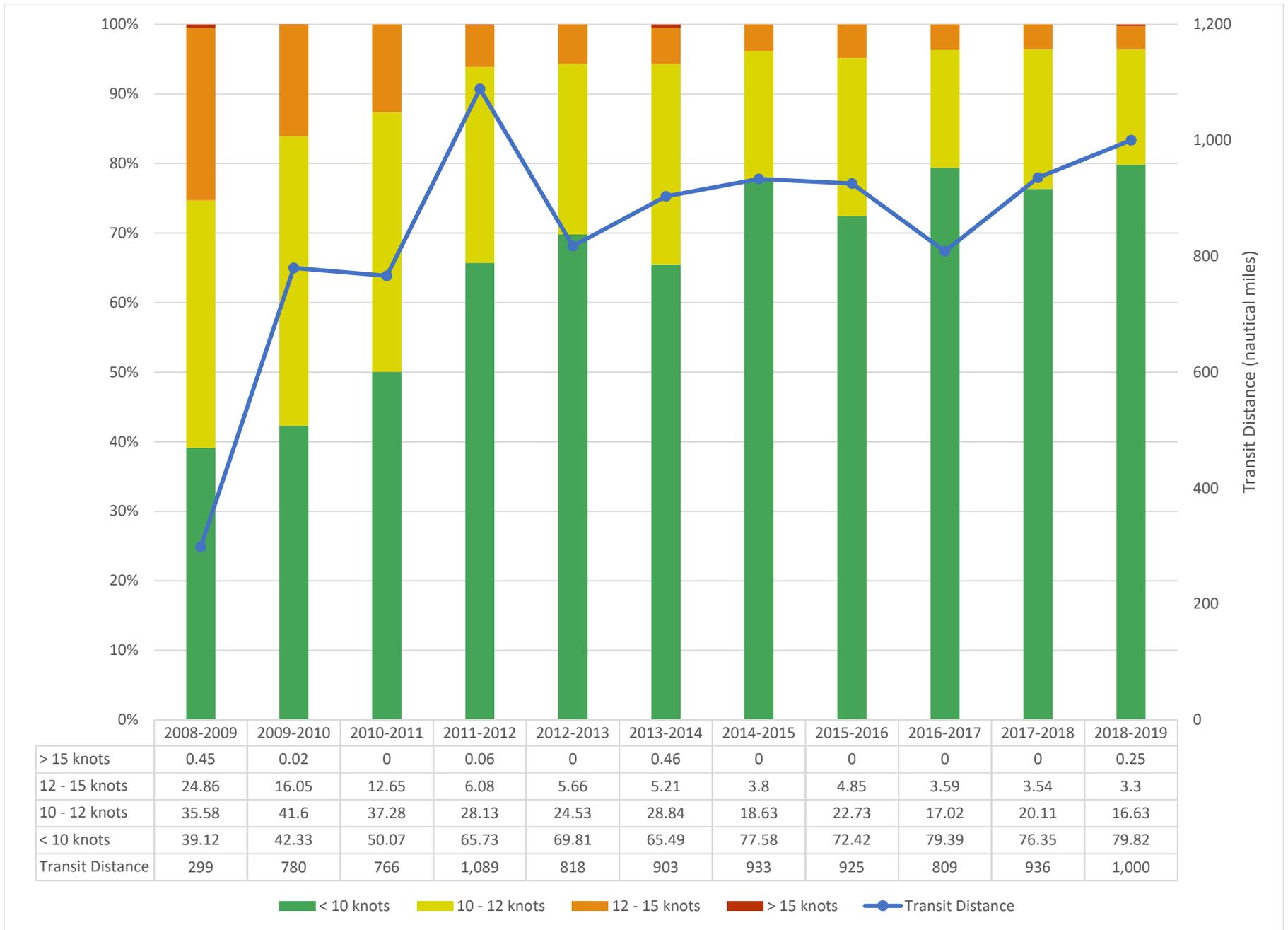


Figure 44. Proportion of total distance transited by OGVs through the Morehead City Entrance Zone by speed class. The blue line indicates the total distance transited by OGVs.

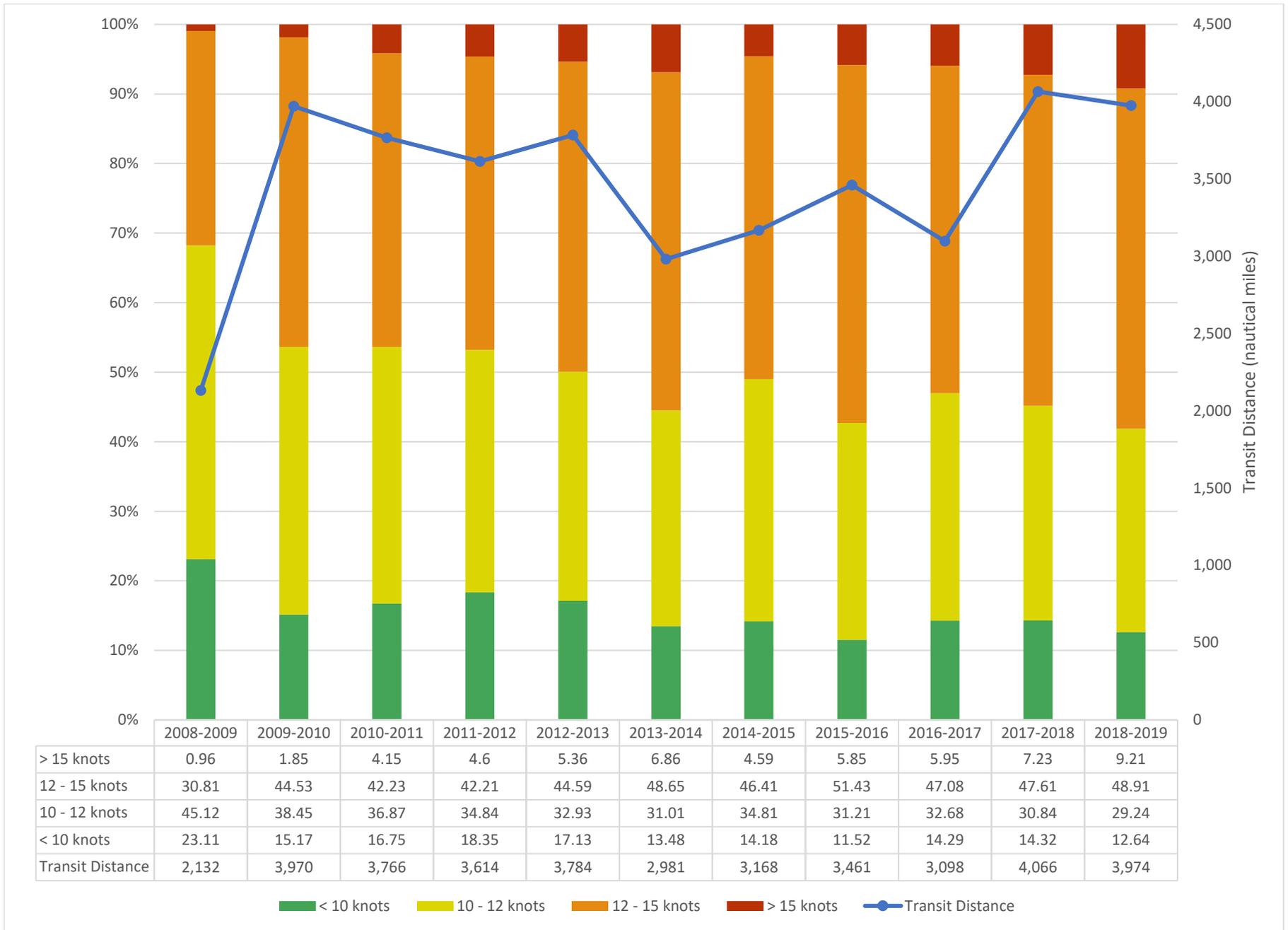


Figure 45. Proportion of total distance transited by OGVs through the Wilmington Entrance Zone by speed class. The blue line indicates the total distance transited by OGVs.

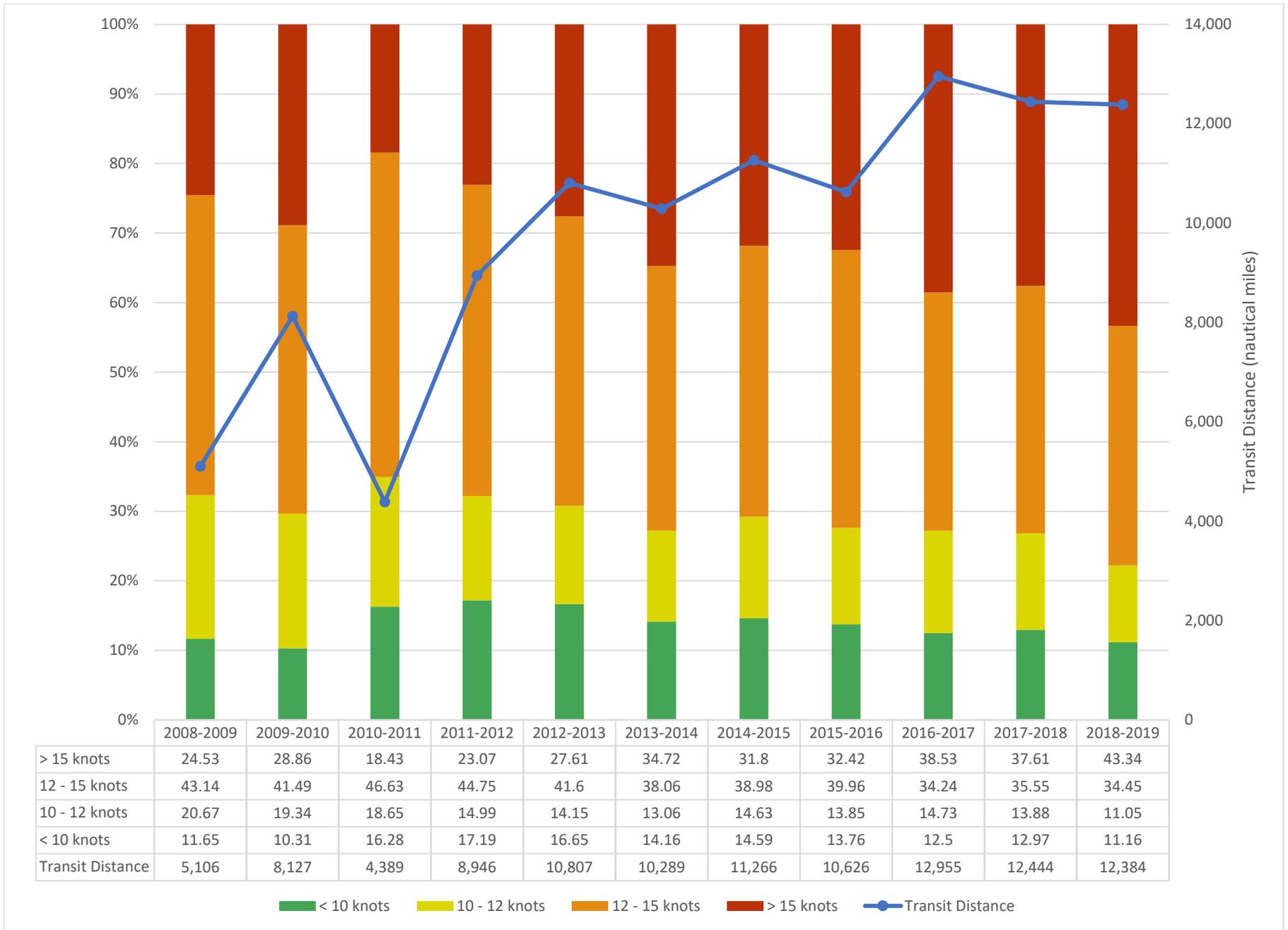


Figure 46. Proportion of total distance transited by OGVs through the Charleston Entrance Zone by speed class. The blue line indicates the total distance transited by OGVs.

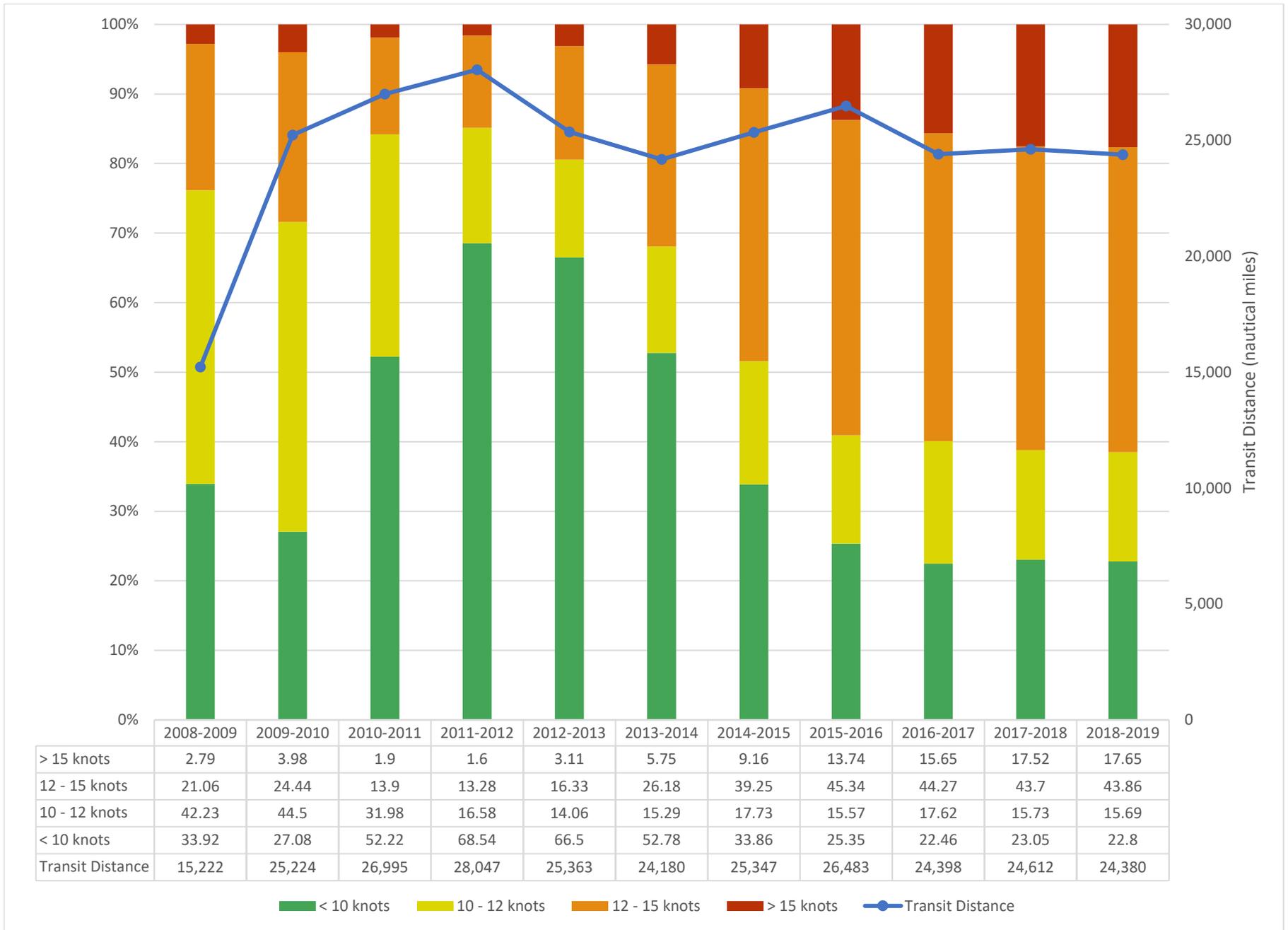


Figure 47. Proportion of total distance transited by OGVs through the Savannah Entrance Zone by speed class. The blue line indicates the total distance transited by OGVs.

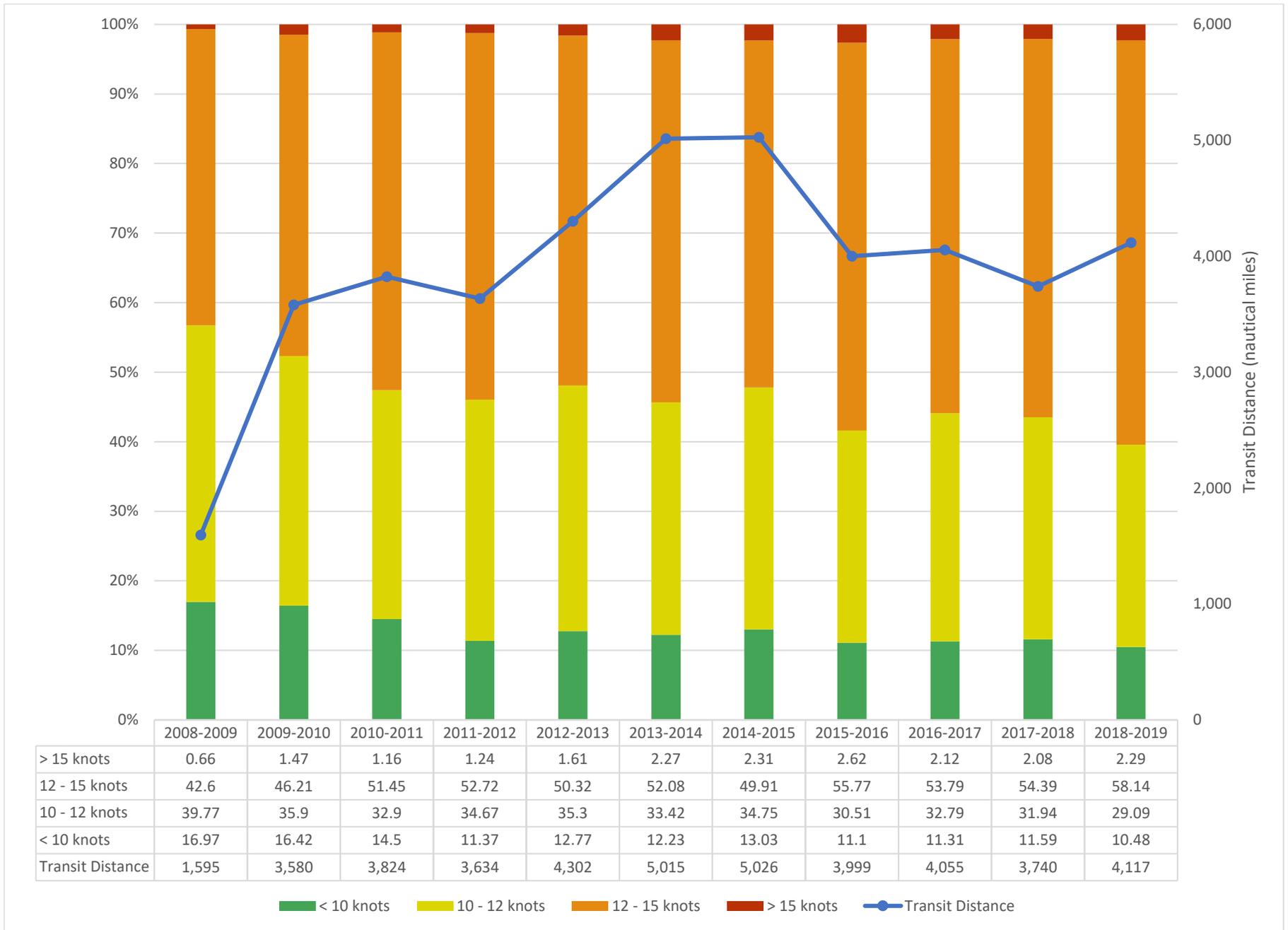


Figure 48. Proportion of total distance transited by OGVs through the Brunswick Entrance Zone by speed class. The blue line indicates the total distance transited by OGVs.

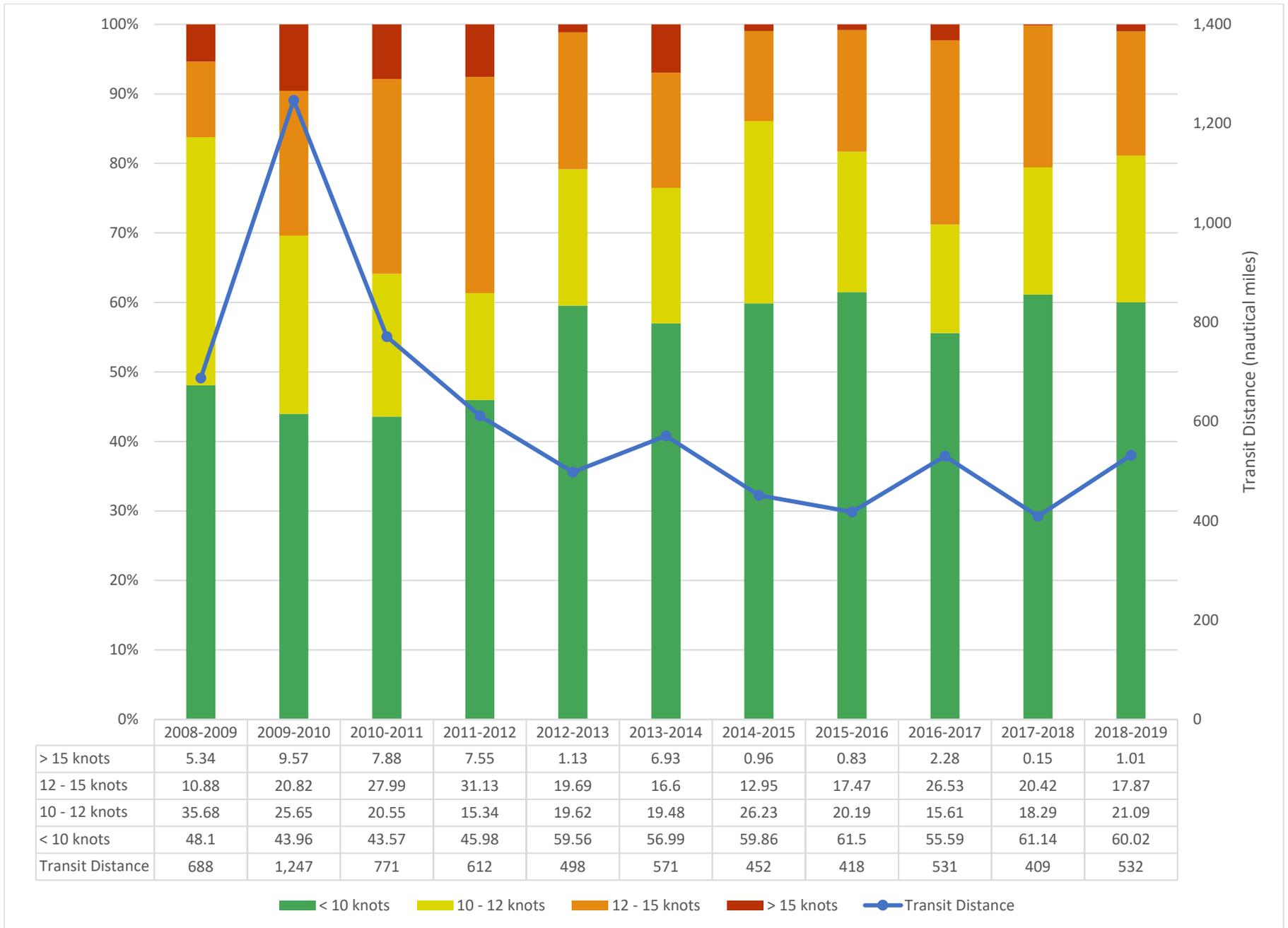


Figure 49. Proportion of total distance transited by OGVs through the Fernandina Entrance Zone by speed class. The blue line indicates the total distance transited by OGVs.



Figure 50. Proportion of total distance transited by OGVs through the Jacksonville Entrance Zone by speed class. The blue line indicates the total distance transited by OGVs.

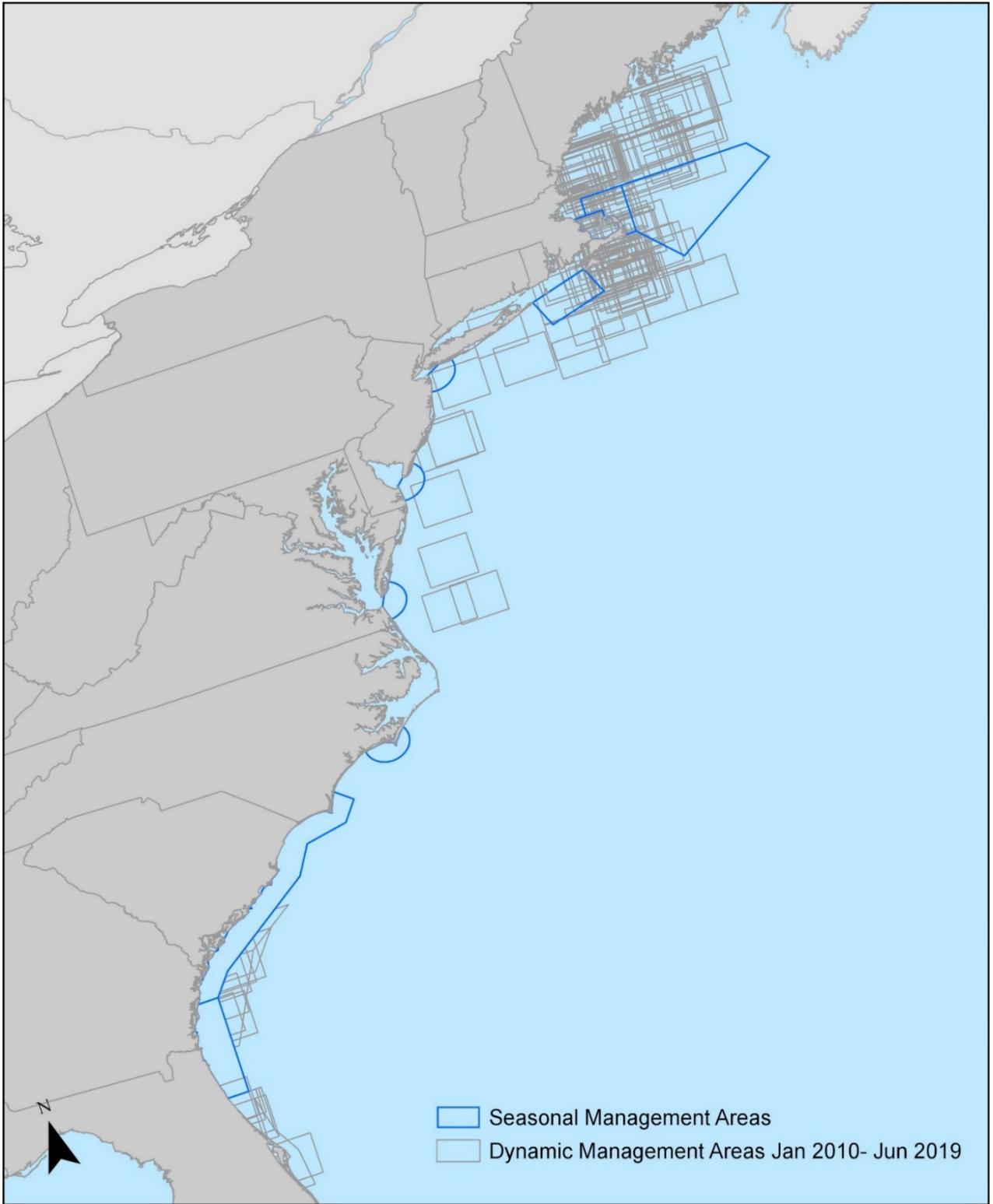


Figure 51. Subset of Dynamic Management Areas (January 2010 - June 2019).

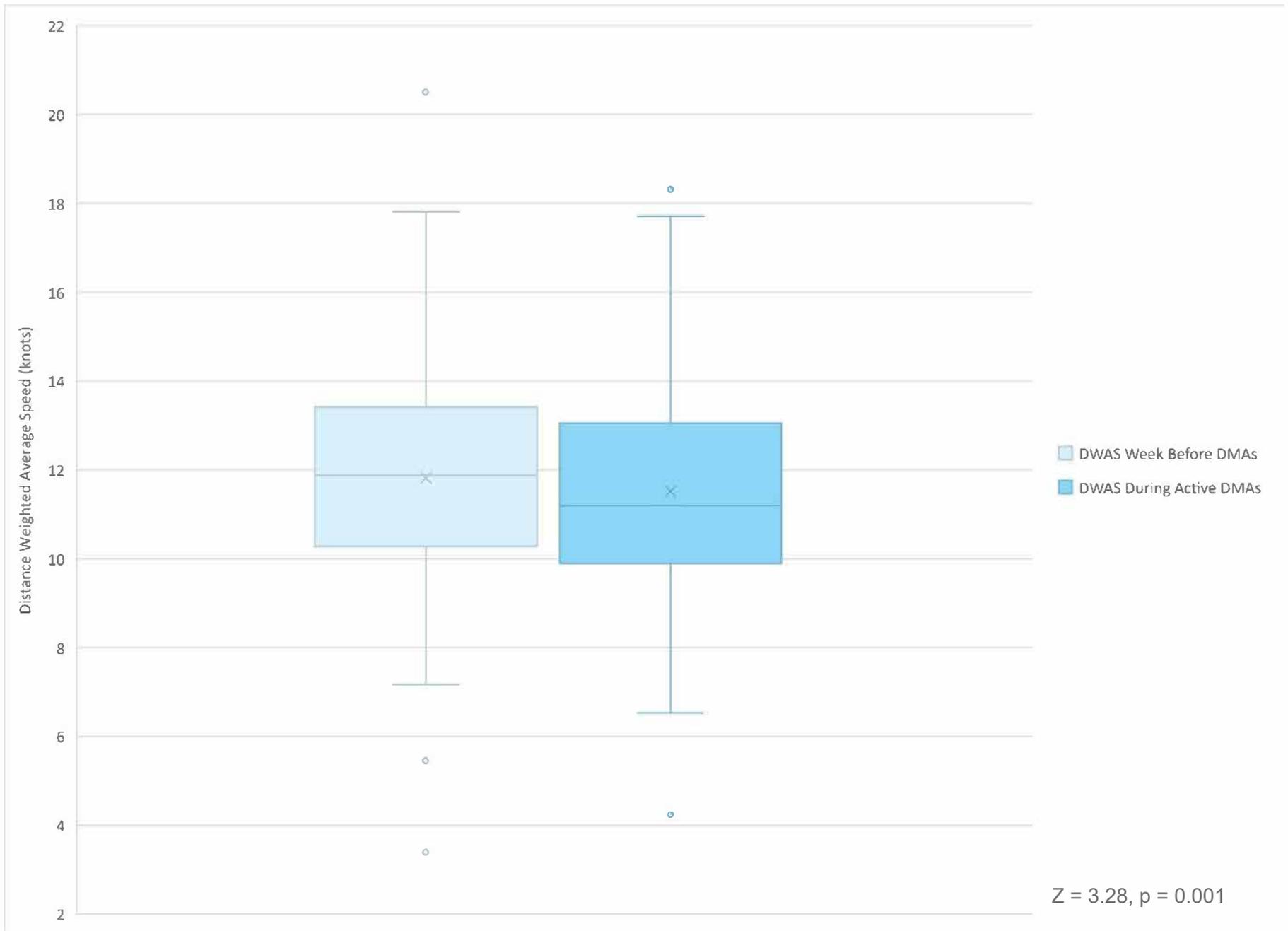


Figure 52. Distance weighted average speed (DWAS) of vessel transits through active DMAs (dark blue) and inactive DMAs the week before (light blue).

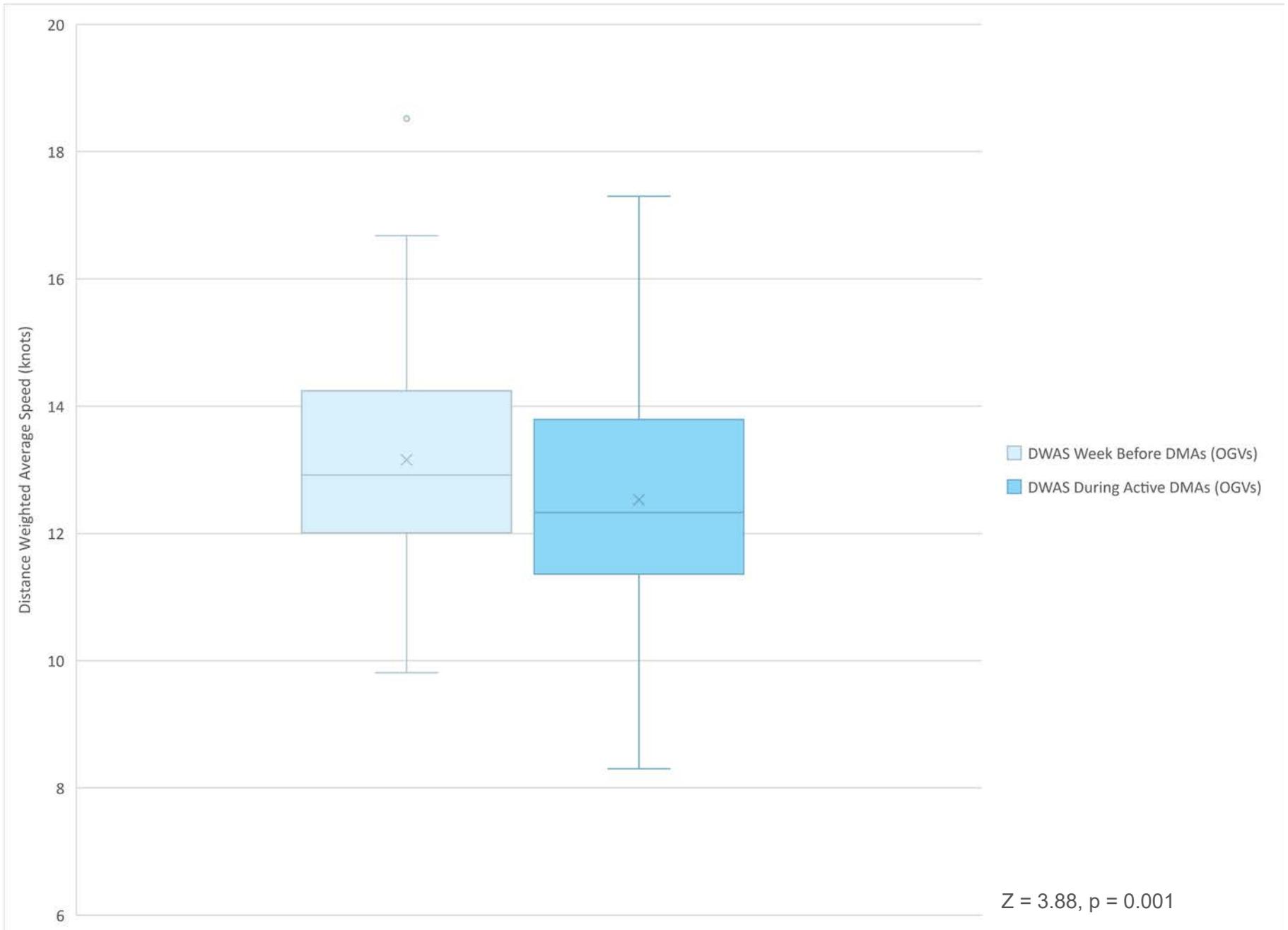


Figure 53. Distance weighted average speed (DWAS) of OGV transits through active DMAs (dark blue) and inactive DMAs the week before (light blue).

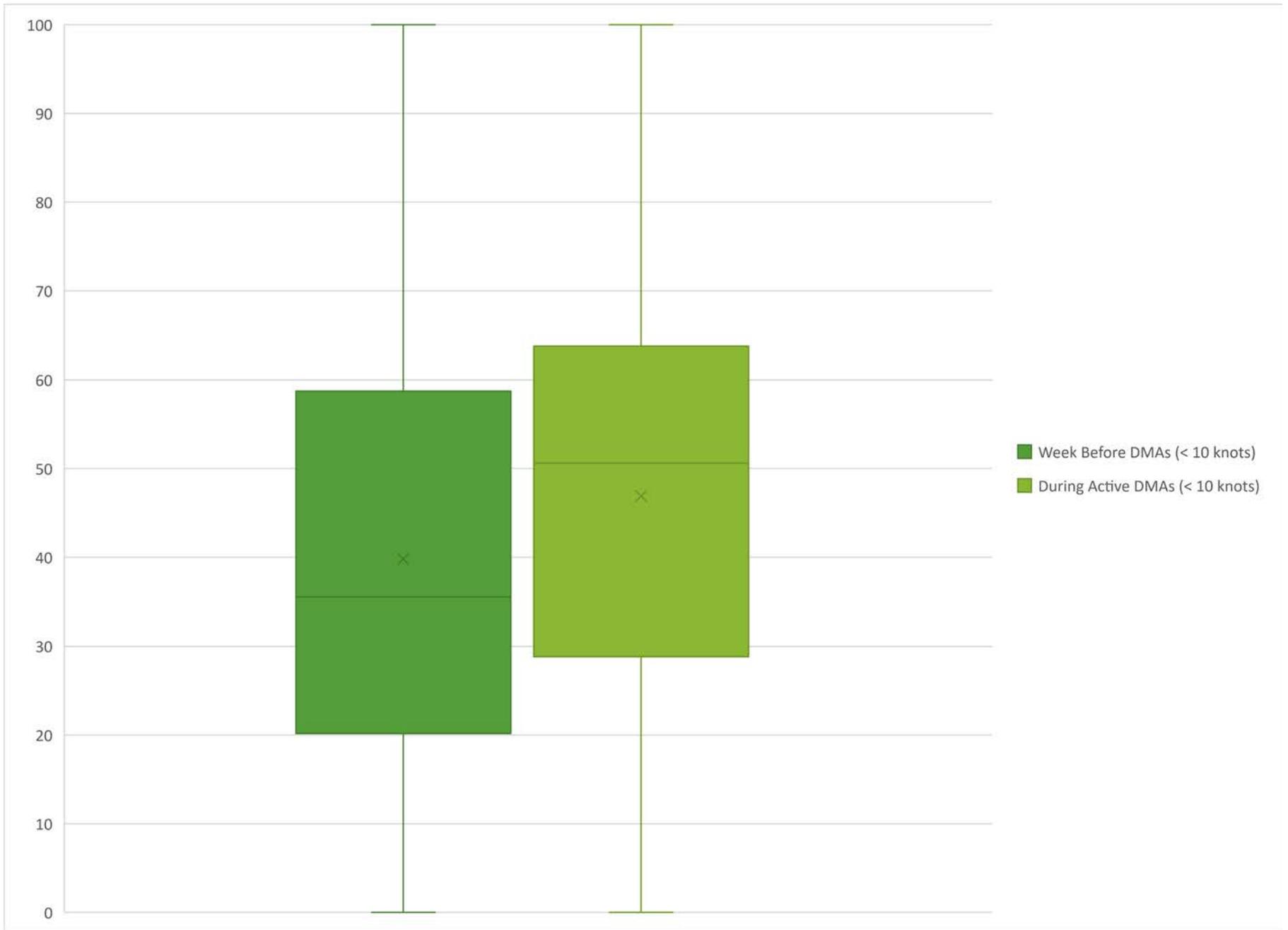


Figure 54. Proportion of vessel traffic cooperating with the 10 knot speed request during DMA active periods (light green) and the week before (dark green).

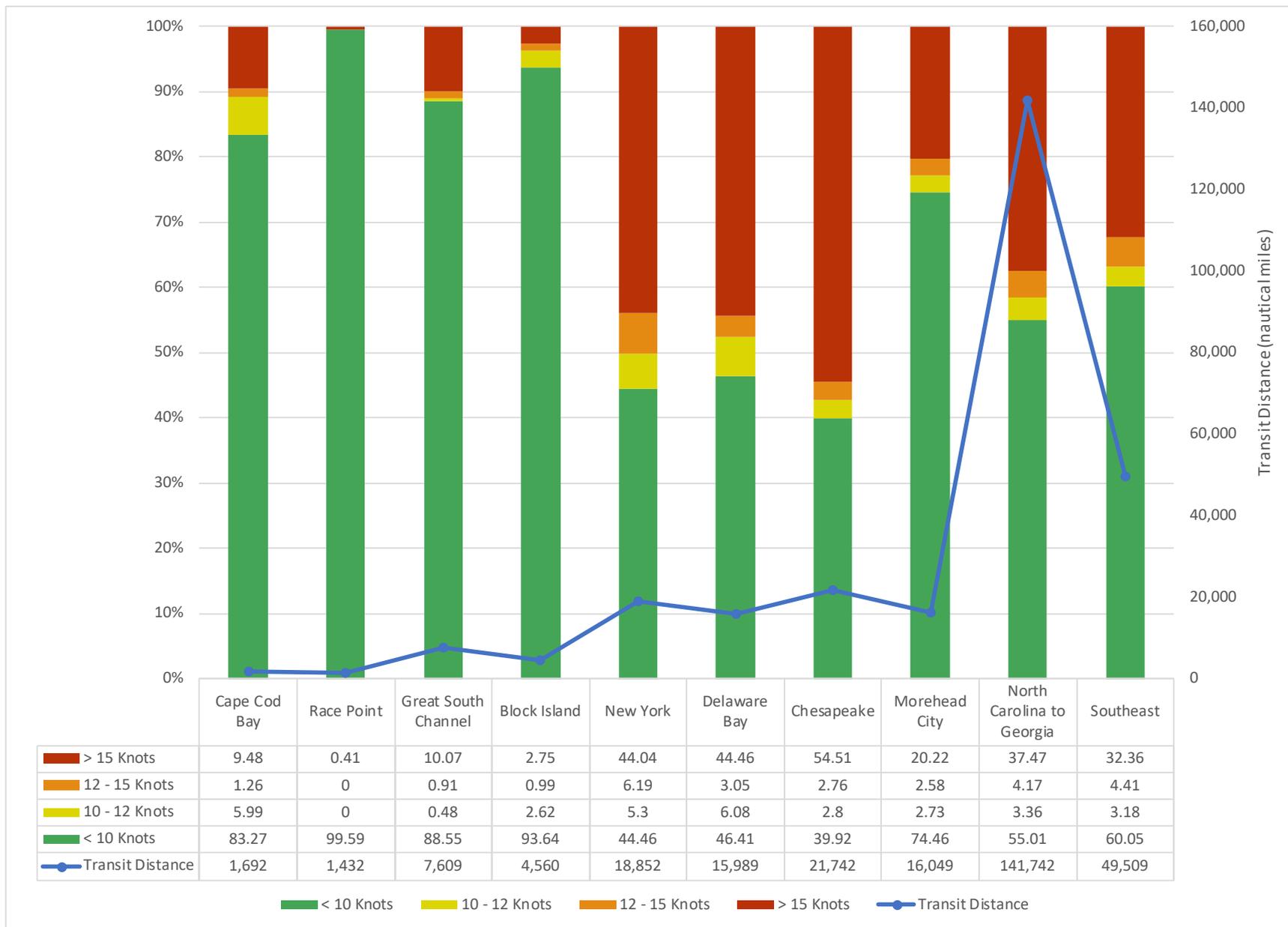


Figure 55. Proportion of total distance traveled by small vessels (< 65 ft) through each active SMAs by speed class during the 2018-2019 SMA season. The blue line indicates the total distance transited in each SMA. Small vessels are not subject to the speed rule.

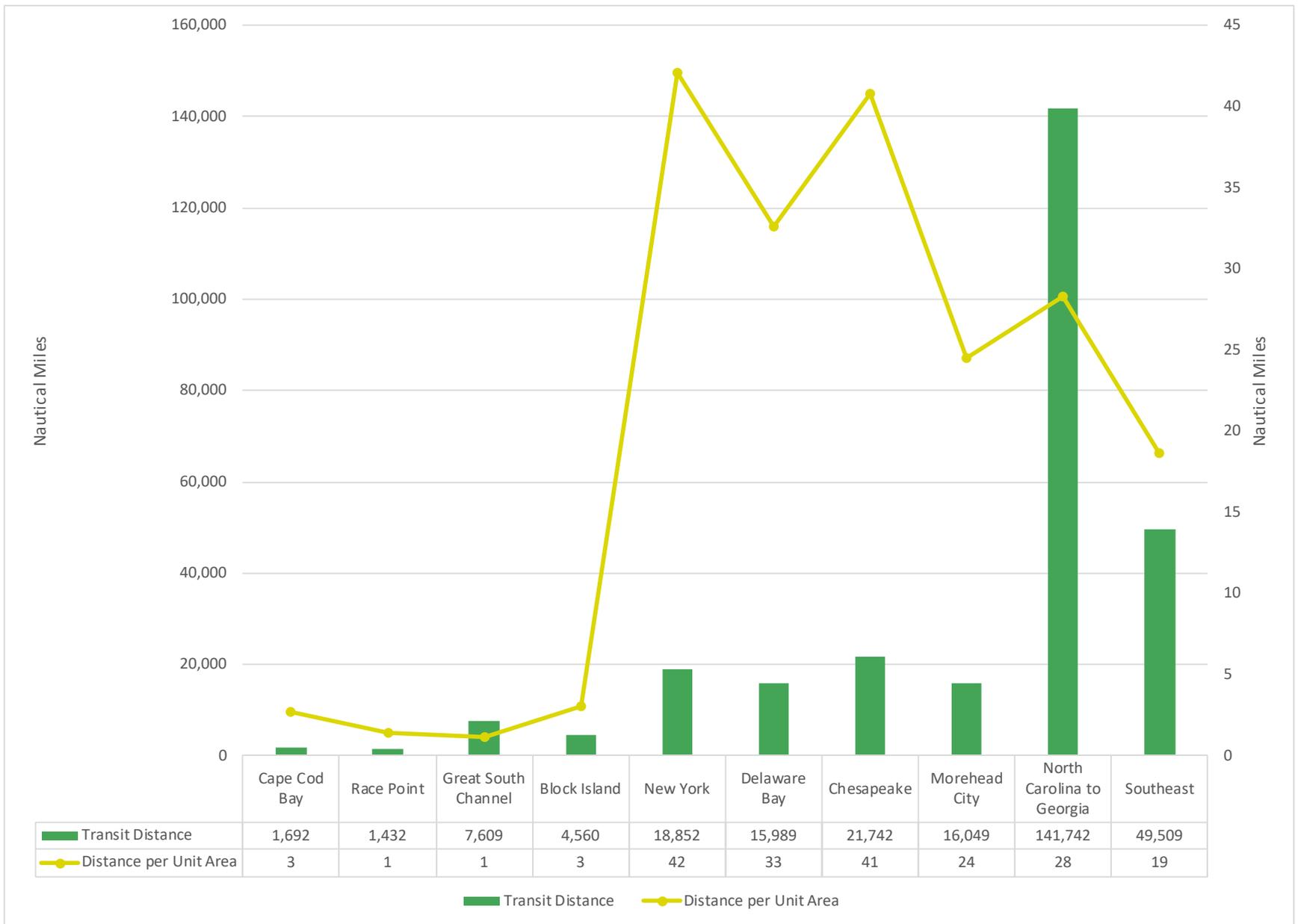


Figure 56. Total transit distance for small vessels (<65ft) through each SMA during the 2018-2019 season (green bars). The yellow line indicates the distance per unit area of small vessel transits through each SMA. Small vessels are not subject to the speed rule.

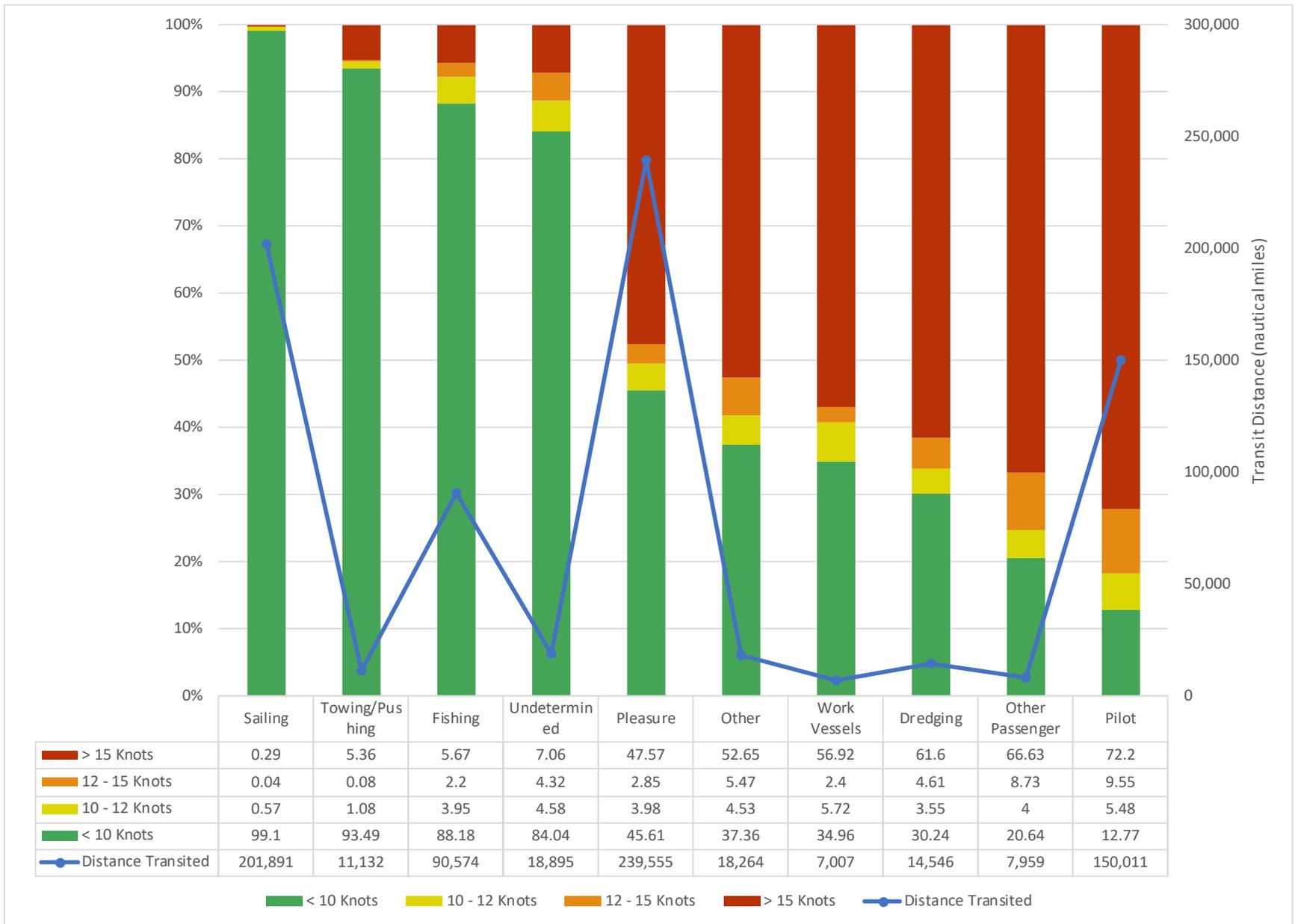


Figure 57. Proportion of total distance transited through all active SMAs by (small) vessel type during the 2018-2019 SMA season. The blue line indicates the total distance transited by each vessel type across all SMAs. Small vessels are not subject to the speed rule.

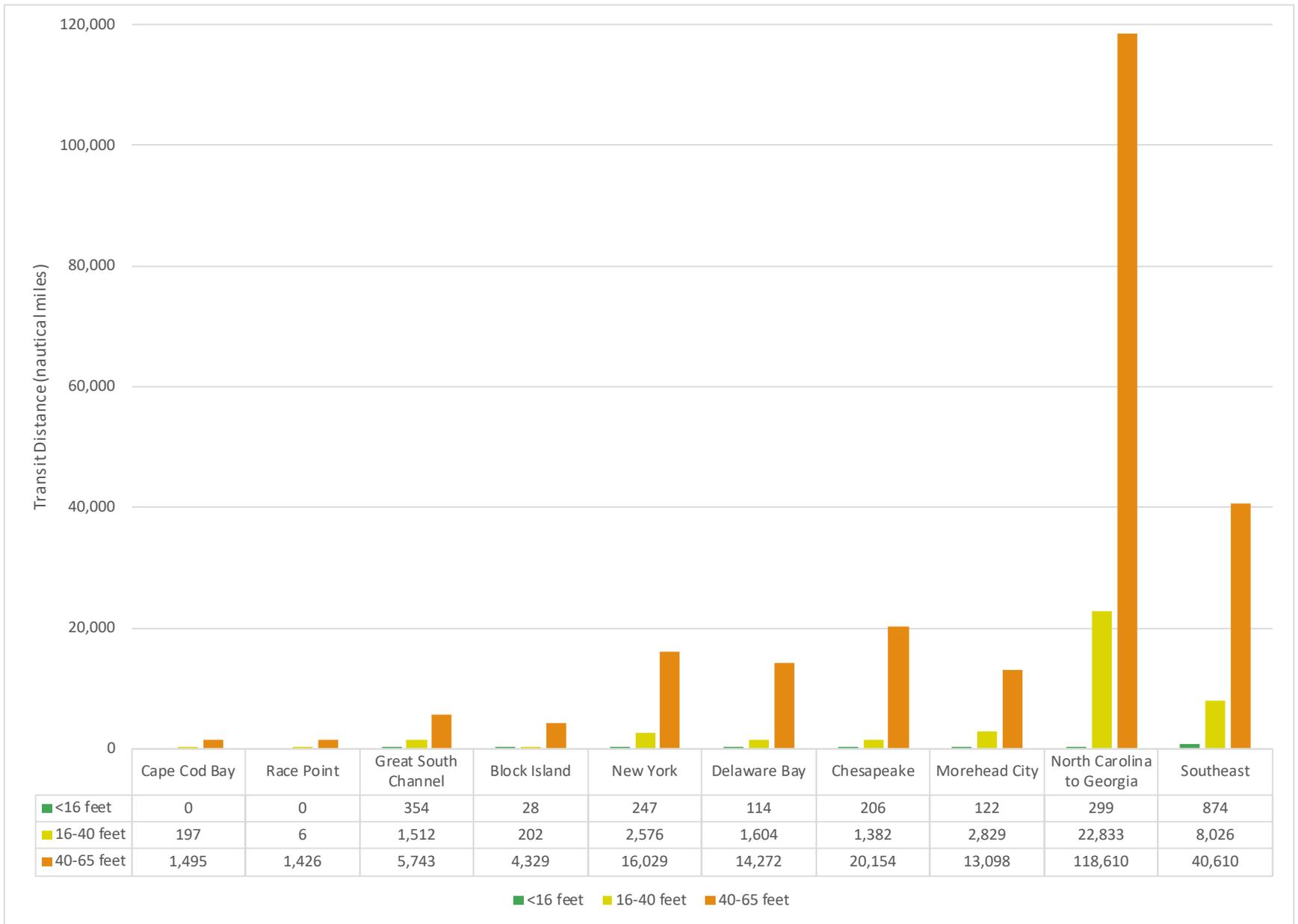


Figure 58. Total distance traveled by small vessels (<65ft) active in each SMA during the 2018-2019 season by vessel size class. Small vessels are not subject to the speed rule.

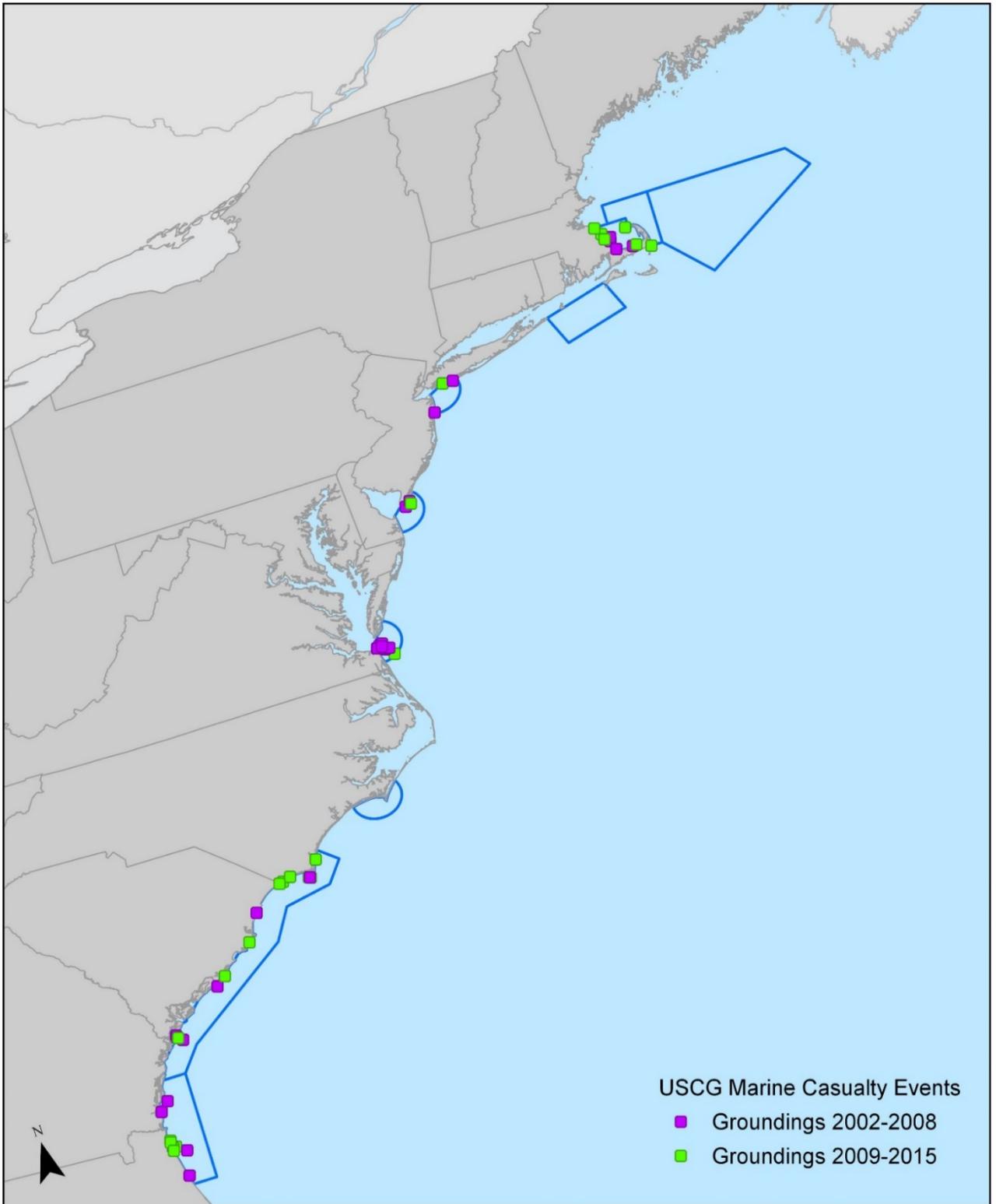


Figure 59. Marine casualty groundings January 2002 – July 2015.

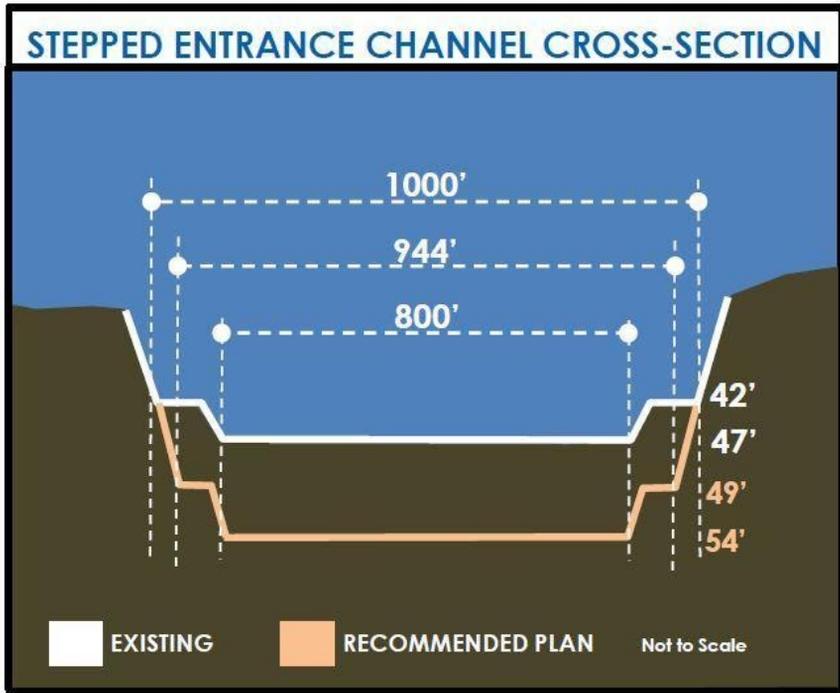


Figure 60. Charleston Entrance Channel Cross Section.
 Source: USACE Charleston Harbor Port 45, Final Integrated Feasibility Report and Environmental Impact Statement, June 2015.

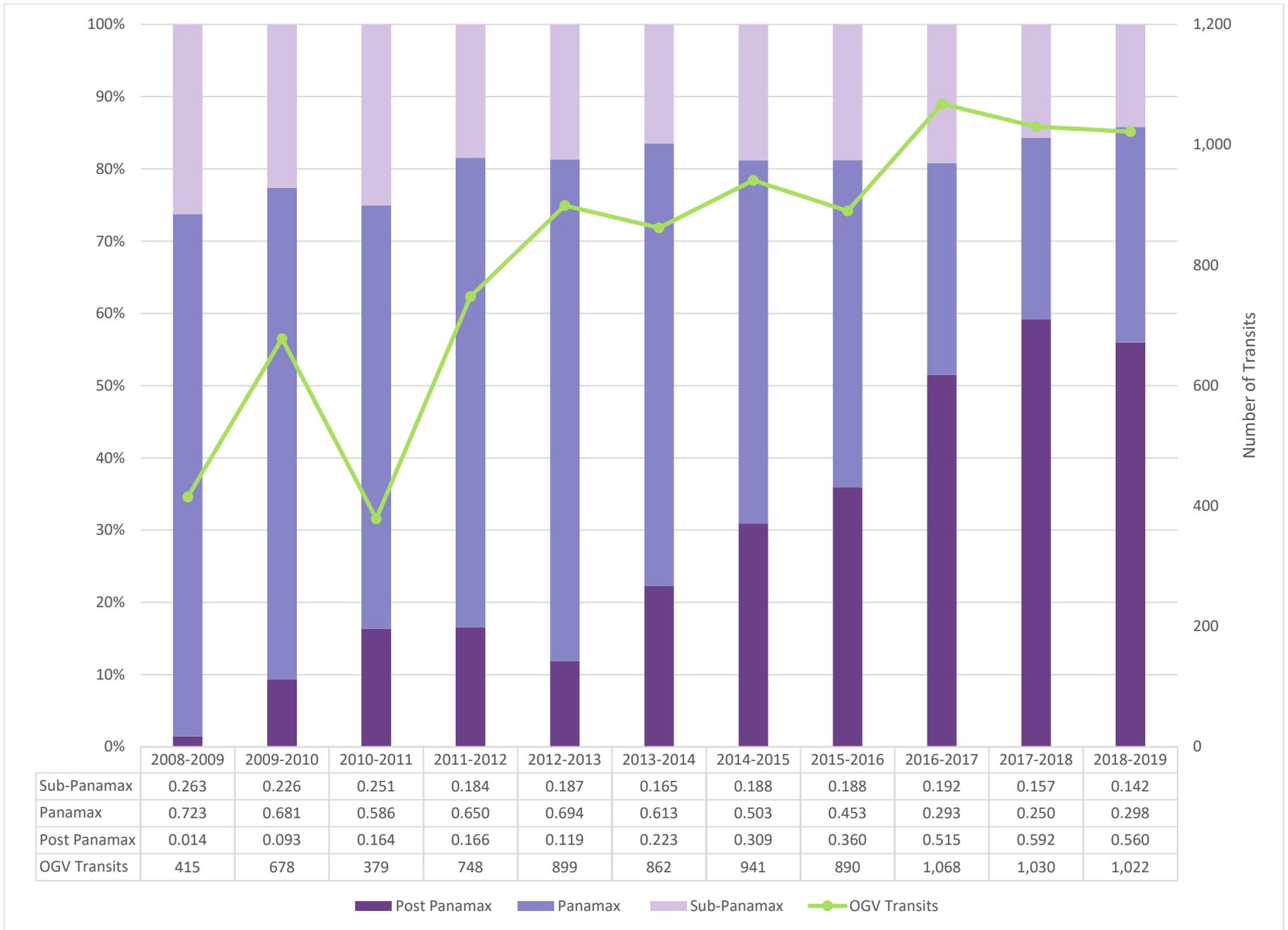


Figure 61. Proportion of OGV transits through the Charleston entrance area by size class each season. The green line indicates the total number of OGV transits each season.

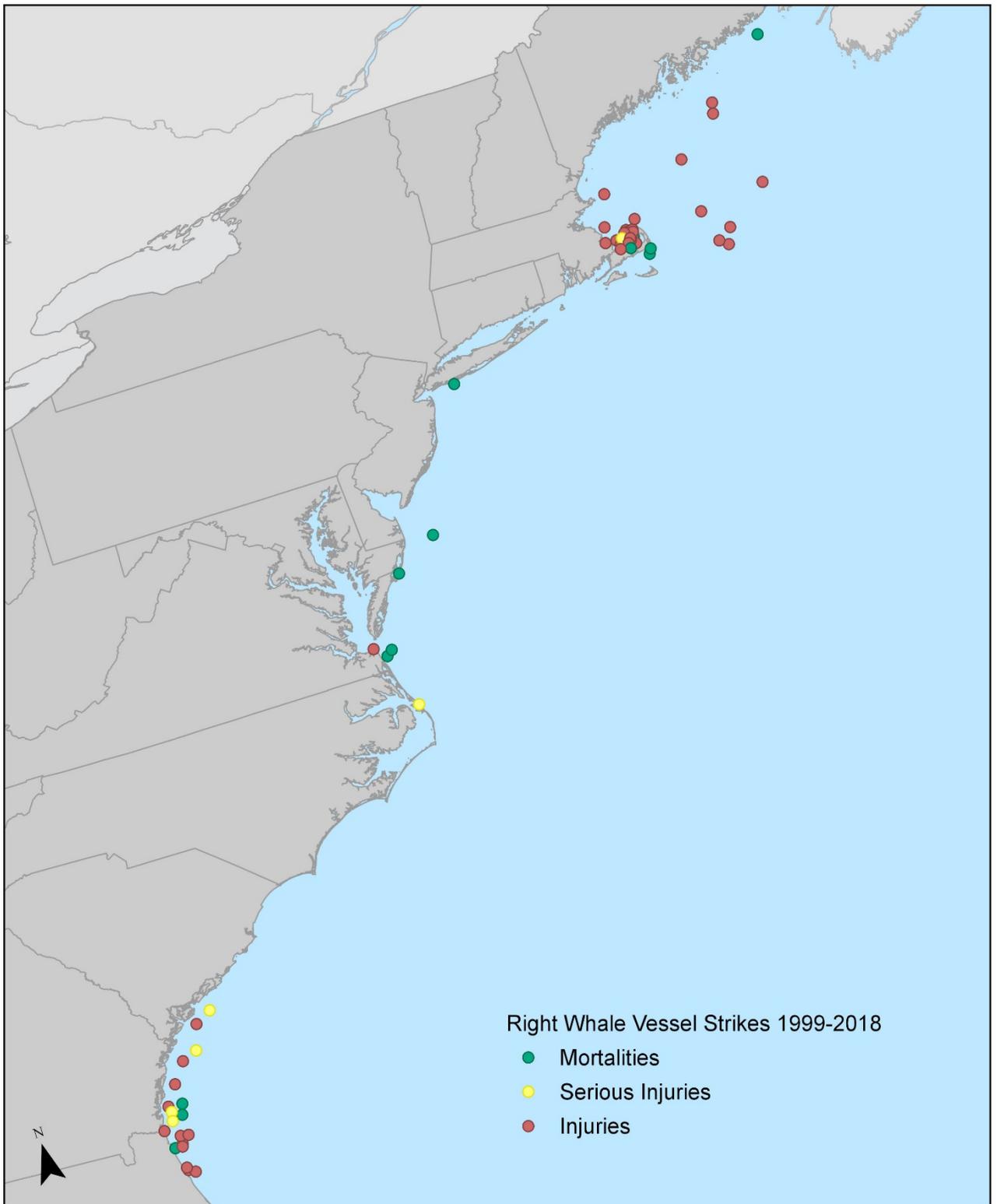


Figure 62. Right whale vessel strikes 1999-2018 indicated by the severity of the event. Locations denote either 1.) where a carcass was found, 2.) where a vessel collision was reported or 3.) where a vessel collision serious injury/injury was first observed on a whale.

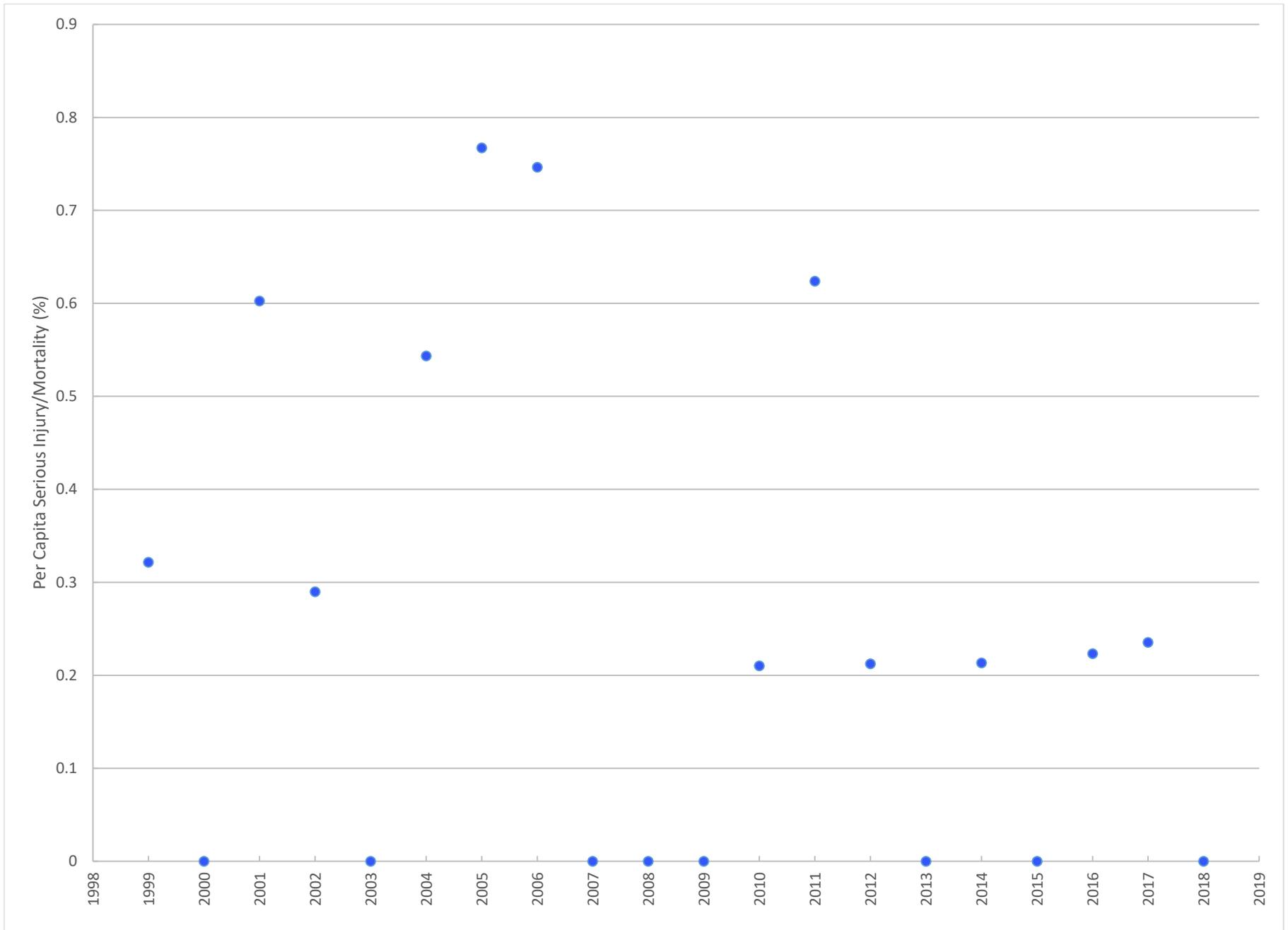


Figure 63. North Atlantic right whale serious injury/mortality rates from documented vessel strikes 1999-2018. Data includes confirmed U.S. events and events first sighted in U.S. waters but of unconfirmed geographic origin.

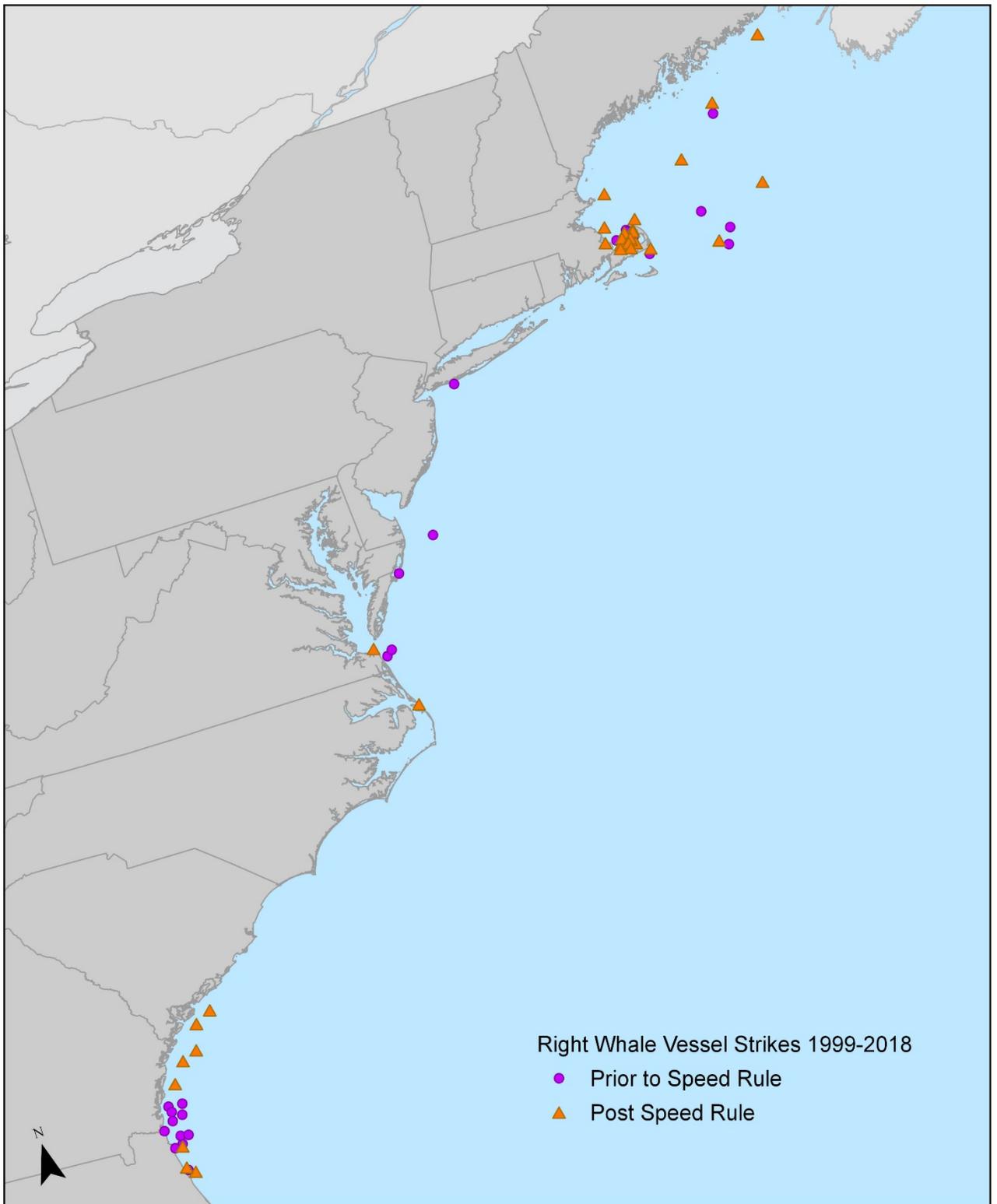


Figure 64. Right whale vessel strike events occurring prior to implementation to the speed rule (1999-2008) and following implementation of the speed rule (2009-2018). Locations denote either 1.) where a carcass was found, 2.) where a vessel collision was reported or 3.) where a vessel collision serious injury/injury was first observed on a whale.

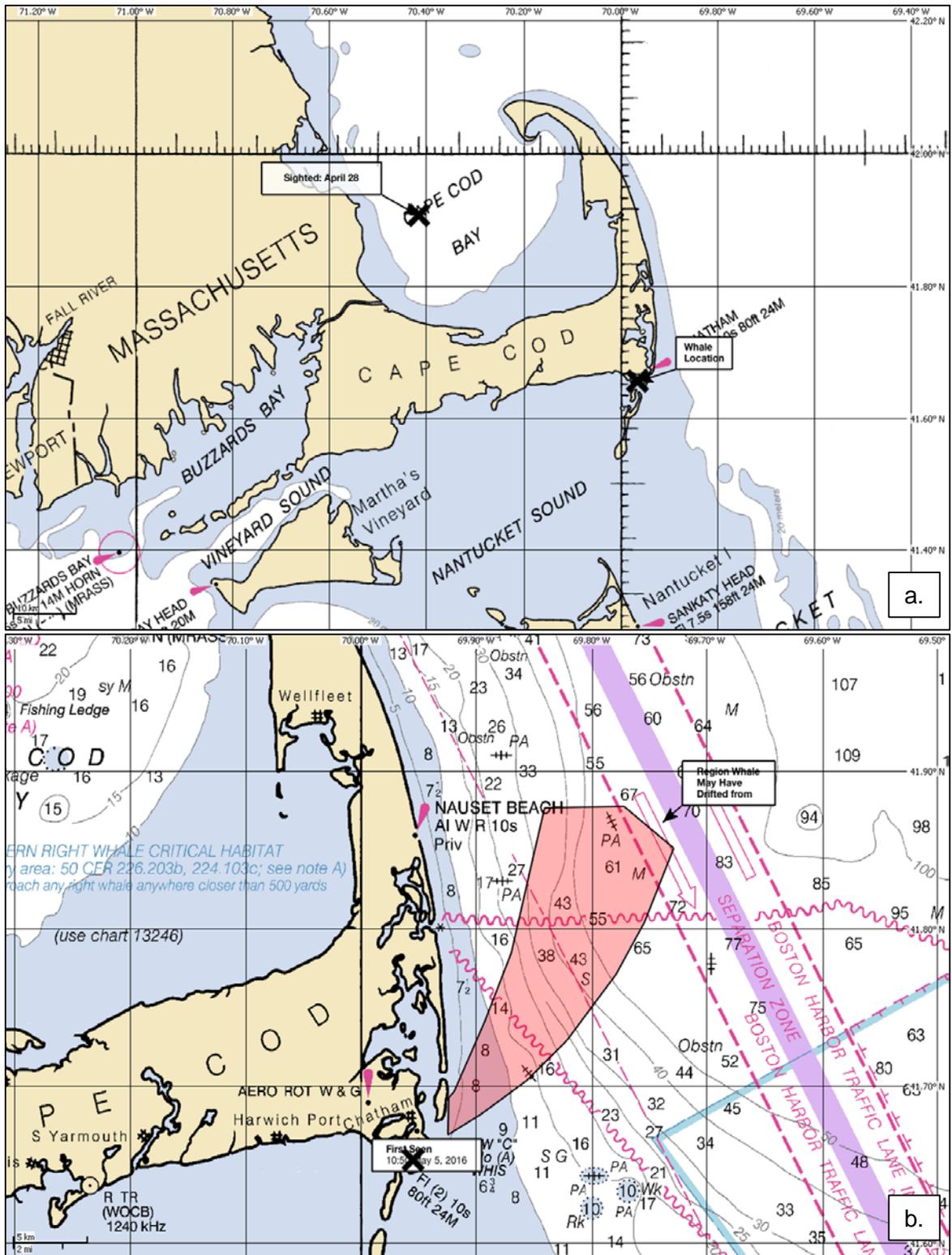


Figure 65. a.) Locations of right whale #4681 when last sighted alive on 4/28/2016 and where found dead on 5/5/2016. b.) Hindcast model output indicates (in pink) the region where the whale may have been struck by a vessel before being found off Chatham, MA. Source: NOAA Office of Response and Restoration.

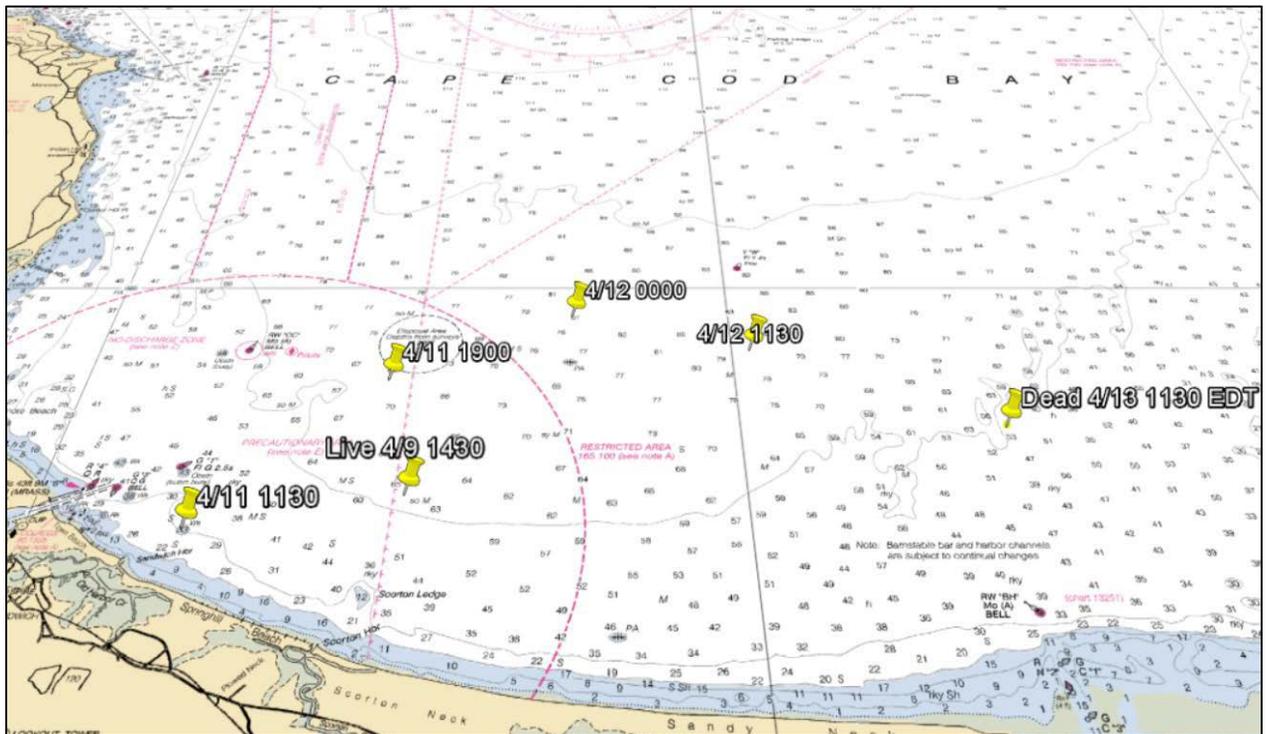


Figure 66. Locations of right whale #4694 when last sighted alive on 4/9/2017 and where found dead on 4/13/2017. She was estimated to have died 48 hours before being sighted. The position on 4/11/2017 at 11:30am is the best estimate of where the vessel strike may have occurred. Source: NOAA Office of Response and Restoration.

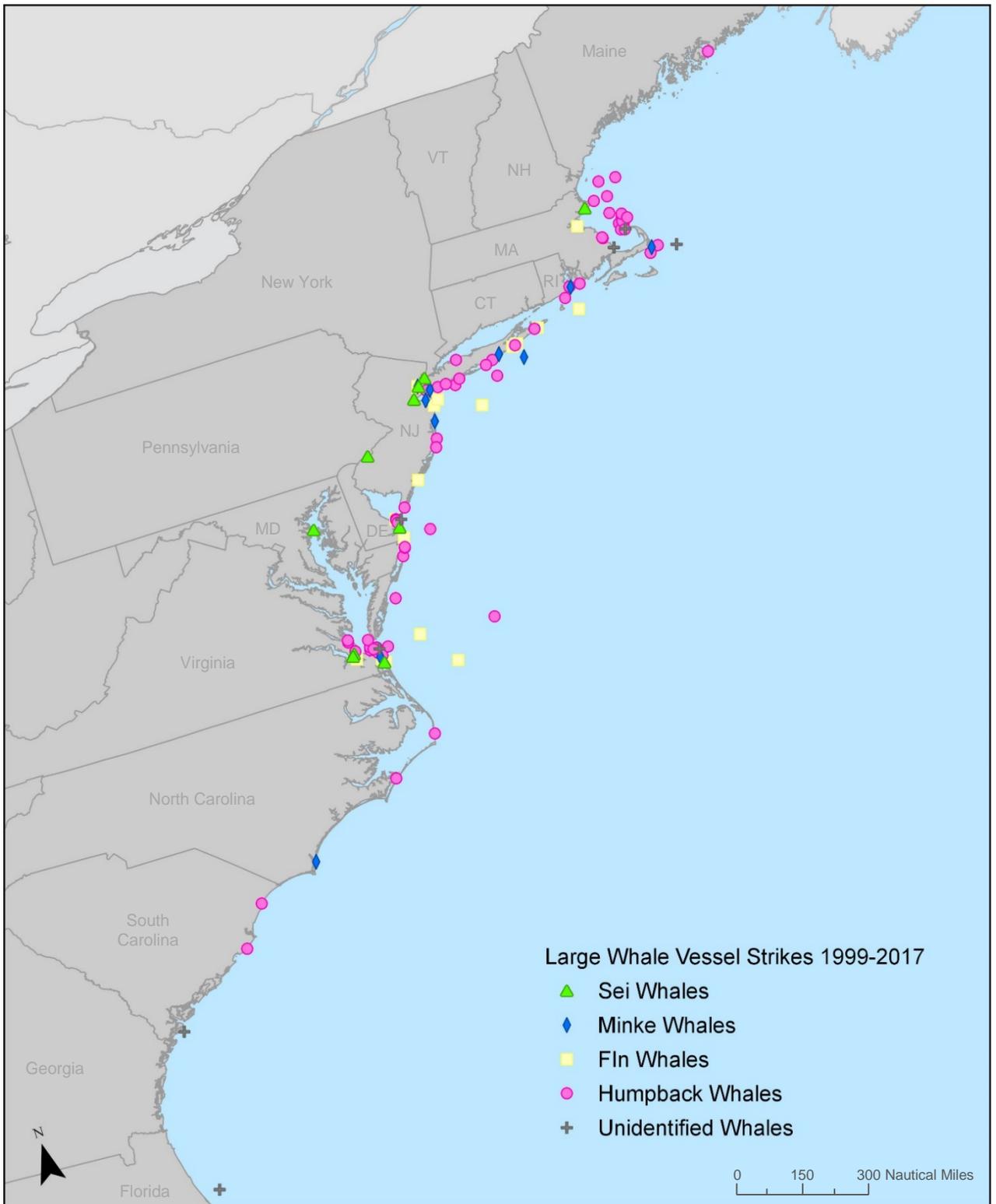


Figure 66. Large whale vessel strike events 1999-2017. Locations denote either 1.) where a carcass was found, 2.) where a vessel collision was reported or 3.) where a vessel collision serious injury/injury was first observed on a whale.

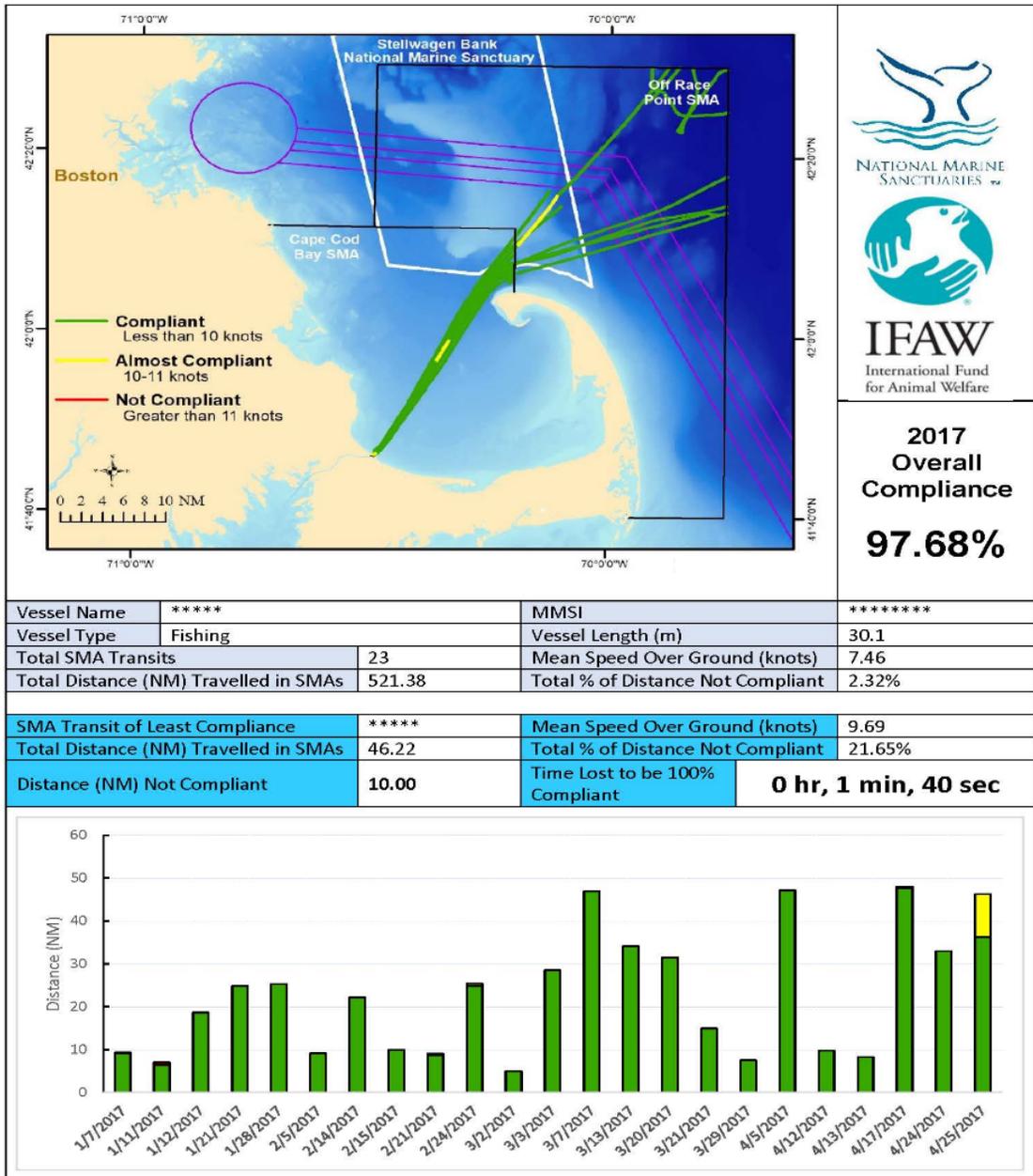


Figure 68. An example “report card” issued to a vessel transiting the Stellwagen Bank National Marine Sanctuary in 2017 as part of the Right Whale Corporate Responsibility Project.

VOLUNTARY RIGHT WHALE SPEED RESTRICTION ZONE

VOLUNTARY DYNAMIC MANAGEMENT AREAS (DMAs)

Mariners are requested to avoid or transit at 10 knots or less inside the following areas where persistent aggregations of right whales have been sighted. Please visit www.nmfs.noaa.gov/pr/shipstrike for more information.

NOTE Nantucket, MA DMA -- in effect through Feb 6, 2020

41 11 N

40 22 N

069 32 W

070 37 W

ACTIVE SEASONAL MANAGEMENT AREAS (SMAs)

Mandatory speed restrictions of 10 knots or less (50 CFR 224.105) are in effect in the following areas:
SMAs in effect –

Mid-Atlantic SMA November 1 through April 30

Cape Cod Bay SMA Jan 1 through May 15

FOR RECENT RIGHT WHALE SIGHTINGS, VISIT: www.nefsc.noaa.gov/psb/surveys/ DOWNLOAD THE

WHALE ALERT APP FOR IPAD AND IPHONE: stellwagen.noaa.gov/protect/whalealert.html FOR AN

AUTOMATIC RETURN EMAIL LISTING ALL CURRENT U.S. DYNAMIC MANAGEMENT AREAS AND SEASONAL MANAGEMENT AREAS, PLEASE SEND A BLANK MESSAGE TO: nmfs.gar.rightwhale@noaa.gov

DETAILS AND GRAPHICS OF ALL SHIP STRIKE MANAGEMENT ZONES CURRENTLY IN EFFECT:
<https://www.fisheries.noaa.gov/national/endangered-species-conservation/reducing-ship-strikes-north-atlantic-right-whales>

ACOUSTIC DETECTIONS IN CAPE COD BAY AND THE BOSTON TSS: www.listenforwhales.org

APPROACHING A RIGHT WHALE CLOSER THAN 500 YARDS IS A VIOLATION OF FEDERAL AND STATE LAW.
PLEASE REPORT ALL RIGHT WHALE SIGHTINGS TO: 866-755-NOAA (6622)

ADDITIONAL EMAIL ADDRESSES MAY SUBSCRIBE TO THIS DISTRIBUTION LIST BY VISITING:
www.nero.noaa.gov/shipstrike

Figure 69. Example of a Local Notice for Mariners announcement of a Dynamic Management Area (DMA) declaration south of Nantucket in January 2020.

Table 1. Number of vessels greater than 65 ft in length (by type) that transited through active SMAs each season. Note: The increase in some vessel types over time may reflect changes to AIS requirements or increases in voluntary AIS adoption.

Vessel Type	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018	2018-2019
Tanker	623	764	759	736	706	658	671	686	730	707	743
Bulk Carrier	346	581	589	646	641	682	700	606	651	742	704
Container	473	485	540	554	515	548	601	598	535	555	549
Ro-Ro	212	274	284	282	281	280	304	302	315	320	331
General Cargo	344	468	459	427	394	373	391	386	367	327	307
Passenger (Cruise)	19	32	32	33	33	30	37	38	35	42	38
Fishing	16	44	107	130	172	159	187	451	533	530	487
Towing/Pushing	302	317	339	345	321	329	338	332	339	355	330
Pleasure	52	104	124	167	178	205	192	238	241	292	267
Sailing	21	35	46	71	68	65	78	76	97	89	83
Other Passenger	18	18	25	33	39	29	26	49	55	56	50
Dredging	8	13	11	22	18	23	19	18	23	27	24
Work Vessel	26	24	19	21	30	27	26	29	32	37	46
Research	13	20	18	25	22	19	22	23	16	22	19
Pilot	7	5	5	2	2	2	3	5	4	4	5
Pollution Control	1	5	3	3	4	5	3	3	4	2	3
Undetermined	35	54	56	80	69	60	55	73	74	86	73
Other	22	31	24	25	26	34	33	41	49	52	56
Other Cargo	22	36	10	7	33	4	2	1	0	2	2

Table 2. North Atlantic right whale vessel strike events 1999-2018.

Date	Individual ID	Age Class	Sex	Fate	Location
02-Apr-99	1014	adult	F	mortality	Cape Cod Bay, MA
29-Jan-01	1160	adult	F	injury	Florida
17-Mar-01	unknown	calf	M	mortality	Assateague Island, VA
18-Jun-01	unknown	calf	F	mortality	2 mi off Jones Inlet, Long Island, NY
22-Aug-02	3102	juvenile	F	mortality	23 mi ENE of Ocean City Inlet, MD
26-Jan-03	3317	calf	F	injury	off Jacksonville Beach, FL
31-May-03	2201	adult	M	injury	Great South Channel, Gulf of Maine
01-Jan-04	3450	unknown	F	injury	Georgia
07-Feb-04	1004	adult	F	mortality	~ 6 mi off of Virginia Beach, VA
17-Nov-04	1909	adult	F	mortality	Inshore of Chesapeake Bay
12-Jan-05	2143	adult	F	mortality	Cumberland Island, GA
27-Jan-05	2753	adult	F	injury	N of St. Augustine, FL
24-Feb-05	unknown	unknown	U	injury	8 nm SE of St Simons Island, GA
10-Mar-05	2425	adult	F	serious injury	Cumberland Island, GA
28-Apr-05	2617	adult	F	mortality	South Monomoy Island, Chatham, MA
09-Jun-05	3380	unknown	M	injury	50 nm E of Provincetown, MA
14-Jul-05	unknown	unknown	M	injury	Great South Channel, Gulf of Maine
08-Jan-06	3520	juvenile	F	injury	SEUS calving ground, FL
10-Jan-06	unknown	calf	M	mortality	~5 mi N of Mayport Jetty, Jacksonville, FL
11-Mar-06	3522	juvenile	M	serious injury	7 mi offshore of Cumberland Island, GA
14-Apr-06	3590	juvenile	F	injury	Cape Cod Bay, MA
05-May-06	3590	juvenile	F	injury	Cape Cod Bay, MA
30-Dec-06	3508	juvenile	M	mortality	~10 mi off the coast of Brunswick, GA
22-Jan-07	2413	adult	F	injury	Great South Channel, Gulf of Maine
12-Mar-07	3503	juvenile	F	injury	Cape Cod Bay, off of Provincetown, MA
19-Apr-09	3590	juvenile	F	injury	~7 nm E of Scituate, MA
14-Dec-09	unknown	unknown	U	injury	1.5 nm NW of Cape Henry, VA
15-Dec-09	3745	juvenile	M	injury	26 nm NE of Brunswick, GA
21-Feb-10	3945	juvenile	M	injury	14 nm E of Ossabaw Island, GA
13-May-10	2470	adult	M	injury	49.7 nm ESE of Chatham, MA
02-Jul-10	3901	juvenile	F	mortality	11.6 nm SE of Great Wass Island, ME
30-Aug-10	3966	juvenile	F	injury	8.4 nm NE of Rockport, MA
18-Dec-10	3140	adult	M	injury	71 nm SE of Portland, MA
16-Jan-11	4023	juvenile	M	injury	Florida
20-Jan-11	3853	juvenile	M	serious injury	12 nm SE of Edisto Beach, SC
27-Mar-11	1308	adult	F	mortality	Nags Head, NC
27-Mar-11	2011 Calf of 1308	calf	U	serious injury	Nags Head, NC
08-Apr-11	3620	juvenile	M	injury	Cape Cod Bay, MA
29-Apr-11	3860	juvenile	F	injury	Cape Cod Bay, MA
03-Aug-11	4150	juvenile	F	injury	9.2 nm NE Race Point, Provincetown, MA
26-Nov-11	1331	adult	M	injury	83 nm E of Portland, ME
17-Jan-12	4146	juvenile	F	injury	8.5 nm N of St. Augustine, FL

Table 2 (continued). North Atlantic right whale vessel strike events 1999-2018.

Date	Individual ID	Age Class	Sex	Fate	Location
26-Jan-12	4091	juvenile	F	injury	Cape Cod Bay, MA
26-Jan-12	3951	juvenile	M	injury	Cape Cod Bay, MA
04-Mar-12	3701	juvenile	M	injury	Cape Cod Bay, MA
18-May-12	3980	juvenile	F	injury	94.2 nm E of Truro, MA
07-Dec-12	unknown	unknown	U	serious injury	24.1 nm E of Ossabaw Island, GA
29-Jan-13	2013 Calf of 1612	calf	U	injury	8 nm off Mayport, FL
07-Mar-13	3692	adult	F	injury	South Carolina
08-Apr-13	3705	juvenile	F	injury	Cape Cod Bay, MA
09-Apr-14	unknown	adult	U	serious injury	Cape Cod Bay, MA
06-May-15	3999	juvenile	F	injury	7.0 nm S of Wood End, Provincetown, MA
11-May-15	4545	calf	F	injury	Cape Cod Bay, MA
02-Sep-15	unknown	calf	U	injury	Plymouth Bay, MA
03-May-16	4681	calf	M	mortality	Morris Island, MA
13-Apr-17	4694	juvenile	F	mortality	1.5 nm NW of Dennis, MA
01-Mar-18	4145	juvenile	M	injury	Cape Cod Bay, MA

Source: Baleen Whale Mortality and Serious Injury Reports, Northeast Fisheries Science Center, NOAA Fisheries <https://www.fisheries.noaa.gov/resource/publication-database/marine-mammal-mortality-and-serious-injury-reports>

Table 3. North Atlantic right whale vessel strike mortalities, serious injuries, and injuries 1999-2018 (n = 57). Data includes both confirmed U.S. events and events first sighted in U.S. waters but of unconfirmed geographic origin.

Time Period	US Mortalities	US Serious Injuries	US Injuries	First Seen US Mortalities	First Seen US Serious Injuries	First Seen US Injuries	Total
1999-2008	10	2	5	0	0	8	25
2009-2018	3	4	10	1	0	14	32
Total	13	6	15	1	0	22	57

Table 4. Large whale (not including known right whale) vessel strike mortalities, serious injuries and injuries 1999-2017 (n = 131). Data includes both confirmed U.S. events and events first sighted in U.S. waters but of unconfirmed geographic origin.

Species	Humpback			Fin		Minke	Sei	Unknown	Total
	Mortalities	Serious Injuries	Injuries	Mortalities	Injuries	Mortalities	Mortalities	Injuries	
1999 - 2008	13	1	11	11	2	2	4	0	44
2009 - 2017	25	4	22	12	2	10	6	6	87
Total	38	5	33	23	4	12	10	6	131

Table 5. Estimated Annual Cost Impact by Vessel Type (2019 dollars) Based on Actual Vessel Compliance with the Speed Rule

VESSEL TYPE	METHOD 1	METHOD 2
Bulk Carrier	\$619,000	\$346,000
Container	\$22,953,000	\$20,025,000
Ro-Ro	\$3,381,000	\$2,825,000
Tanker	\$1,693,000	\$1,110,000
General Cargo	\$578,000	\$461,000
Passenger (Cruise)	\$2,759,000	\$2,677,000
Fishing	\$1,318,000	\$147,000
Towing / Pushing	\$2,619,000	\$244,000
Dredging	\$1,824,000	\$112,000
Passenger (Other)	\$112,000	\$65,000
Pleasure	—	—
Other / Undetermined	\$1,535,000	\$314,000
Total	\$39,391,000	\$28,327,000